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Vol. III

TRANSCRIPT OF RECORD

Supreme Court of the United States

OCTOBER TERM, 1930

No. 90

FRANK L. SMITH, CICERO J. LINDLY, HAL W. TROVILLION, ET AL., ETC., ET AL., APPELLANTS,

vs.

ILLINOIS BELL TELEPHONE COMPANY

APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES FOR THE NORTHERN DISTRICT OF ILLINOIS

FILED APRIL 25, 1930

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IN THE

District Court of the United States

FOR THE NORTHERN DISTRICT OF ILLINOIS,

EASTERN DIVISION.

ILLINOIS BELL TELEPHONE COMPANY,
Plaintiff,

vs.

P. H. MOYNIHAN, HAL W. TROVILLION, WILLIAM J. SMITH, ALEX J. JOHNSON, J. PAUL KUHN, JAMES R. CLARK and DAN JACKSON, the Persons Constituting the Illinois Commerce Commission of the State of Illinois, and OSCAR E. CARLSTROM, Attorney-General of the State of Illinois,
Defendants,

and CITY OF CHICAGO, a Municipal Corporation,
Intervenor.

In Equity No. 3746

ABSTRACT OF RECORD

Volume III

Plaintiff's Rebuttal Testimony

Page of Record

2235 Plaintiff's Exhibits 49A, 49B, 49C, 49D, 49E, 49F, 49G, 49H, 49I, admitted in evidence.

2236 WILLIAM F. SLOAN, recalled as a witness on behalf of the plaintiff in rebuttal, testified:

Direct Examination by Mr. Bangs.

I testified for the plaintiff in this case. I prepared an exhibit marked for identification as Plaintiff's Exhibit #50, which is entitled "Comparative Table Showing the Effect of Weighting Increase Factors." This exhibit was prepared to indicate the extent of the error which might creep into the appraisal which I prepared, by reason of certain
2237 weighting conditions, which both Mr. Wray and Mr. Cummings have discussed in their testimony. Each of them stated that by reason of the fact that the same kinds of material, the same quantities, and the same types were not erected and put into plant each year, that an error has crept into my results because of the fact that I have used a constant weighting of material and labor for each year. Neither Mr. Cummings nor Mr. Wray have stated how much that error amounted to. It was simply pointed out as a possible error.

This table which I have prepared shows the effect of different treatments of that fact. In column 1 the result has been arrived at by the method that I used in my report; that is simply based on taking a constant weighting of material in each of the years and a constant labor gang setup.

I testified in my previous testimony that an error of less than one-half of one percent had crept into the method by reason of the thing that Mr. Wray had pointed out, and I based that statement on the fact that I had taken the quantities of ten specific estimates for each year back to 1914 and tested it out. The results of that test are shown in
2238 Column 2. The material that was taken in each of the years was that indicated on the ten specific estimates corresponding to the items which I did use in my index factors and with the constant gang setup that gave a result of 99.31 per cent of the figure that I had arrived at by my appraisal method.

The next figure shown in Column 3, I took all of the material that was shown in the ten specific estimates and I used the gang makeup for wages that was applicable to each year. I took the kind of labor and the kind of gangs that were used in each of the years. The result obtained by that method was 100.31 per cent. There was about one-third of one per cent difference. For the years 1920 to 1923 inclusive, that is 3½ years, I got all of the material, both specific and routine and I got the actual gang makeups for each year and used those combinations rather than the ones which had been used in my report. My result is shown in the last column which gives an answer 99.64 per cent.

So that I feel that for all practical purposes my method gives an answer that is as correct as it is possible to get by any method. I think the error that has crept in here is smaller than the limits, or the accuracy of any possible
2239 method that could be selected. I don't think this method, or an inventory and appraisal method, or any other method is accurate to that degree. The error that Mr. Wray and Mr. Cummings pointed out is negligible.

I took the three accounts 241, 242, and 245 for analysis because those are the accounts where it was possible to get the material and labor setups. I think the same result would be reached within reasonable limits as to all the accounts if the same computations were made. I don't think the error would be of any appreciable extent whatever. I don't know that it would be exactly as indicated in these three accounts but, in my opinion, it would be on that order.

(Plaintiff's Exhibit No. 50 admitted.)

2240 Plaintiff's Exhibit No. 51 for identification was prepared after listening to the testimony of Mr. Wray that my report contained a serious error by reason of the fact that I had included a large amount of work done on a "piecemeal basis" as he calls it. In order to determine the amount of work that has been performed, not, as I say, on a piecemeal basis, but under what are called routine estimates, I have prepared this exhibit. The book cost of each account is shown

in the first column and in the second and third columns are shown the amounts in percentages of work done under routine and under specific estimates for each of the accounts. That was obtained by taking the sum of the gross additions which equaled the book accounts and which extended from 1911 to 1923 inclusive.

The sum of gross additions in that period did not in each case total the dollars in the books for each account but it enabled us to derive a percentage between routine and specific which I think substantially represents the way the
2241 plant was actually built. By looking at the totals at the bottom of that page you will find practically 60 per cent of the plant has been built under specific estimate and 40 per cent of the plant under routine estimate. The actual figures are 60.2 and 39.8. The dollars for these specific and routine expenditures are shown in the last two columns.

This thing should be pointed out: In account 231, station apparatus, the total of which is $8,322,949, no labor is involved. It is simply the cost of the telephone instruments, so that the factor of routine and specific, or "piecemeal" as Mr. Wray calls it, does not enter into the cost of material. That item is simply a material cost. This is also true of account 222, $873,376. That account is also material. If you put these items over in the specific group you will find that 71 per cent of the total property has been built under what would be called "specific estimates" and 29 per cent under routine.

In addition to that there are certain parts of the property, erected with certain classes of labor, which would be built in identically the manner they are built now, whether it was done under the reproduction theory or under the present way
2242 of building them. I refer particularly to the installation of telephones where the installation gangs have a specific territory and work under a definite program of installing telephones all day long, so there is no more lost time in connection with installing telephones as they are now installed than there would be under the reproduction theory.

That would be true of practically all gangs from account 231 to 235, and also true of the account 243 aerial wire, which is practically all drop wire; that is subscribers' drops from the pole to the premises. If you throw all of those items into the specific group you will find that only 15 per cent of the property is built in any way different than you might conceive it would be built if the property would be reproduced. I got my figure of 17½ per cent by leaving aerial wire in routine. If you throw aerial wire into specific you would get 15 per cent instead of 17½ per cent.

To show how much that affects the proposition, take the case of 71 per cent specific and 29 per cent routine, which is obtained by simply transferring apparatus and other equipment of central offices into the specific estimate group.

2243 Approximately 40 per cent of the remaining 29 per cent done under routine work is labor. Labor is the only item that would be affected by this so-called piecemeal construction. 40 per cent of 29 per cent is 11.77 per cent for labor. Even if we grant Mr. Wray's proposition that piecemeal work, as he calls it, is 30 per cent higher than the other kind of work it would affect the total answer 3½ per cent, which would be obtained by multiplying 30 per cent by 11.77 per cent. However, I do not grant his premise that the work could be done any cheaper under a reproduction theory than it could be as it is done now. I think a large part of the construction work would have to be done under almost identical conditions. I have prepared a map to illustrate the nature of construction work in the City of Chicago.

(Map marked for identification as Plaintiff's Exhibit, 52.)

2244 This map is a section of the cable plant in the Rogers Park District of Chicago. The heavy black lines that have not been marked any other way are the underground conduits leads. Those are the lines running down the middle of the street. The large central lines down the center of the street are continuous and are underground conduits. The branch lines extending laterally from the main leads are aerial cable. They have been marked in red. The green sections are build-

ings that contain house cable. This territory is typical of the aerial plant in the City of Chicago. Perhaps some sections would have been slightly more or slightly less but it is a fairly typical section of the aerial cable plant in Chicago.

The point of the map is to show that the aerial cable is put up in short sections. You will notice many cases where the cable only extends one block. In other sections it extends two blocks. It is that kind of work. If the property were being reproduced it would have to be put back identically in the same way and it is that kind of work that is done under what are called routine estimates.

2245 If they were done under specific estimates there would probably be no great difference in the cost than as actually built. Most of these jobs represent from one to two days' work anyway and they are done by highly efficient gangs that are constantly at this kind of work and the element of lost time in going from one job to another is no greater, in my opinion, than it would be if the property were being reproduced.

(Plaintiff's Exhibits 51 and 52 admitted.)

It might be pointed out that the property on one street might be built, then a gang might skip over four or five streets before the next one was built, under the ordinary way of building the property. But, as a matter of fact, most of the jobs would take from one to two days' complete time of the gang anyway and the next morning, even if they did not go to the adjoining street, there would be no greater amount of lost time than under the way it is actually done. The green sections represent houses or buildings which have cable in

2246 them and each job is a separate job. The men work on that job until it is finished and then go to the next job; so there is no greater amount of lost time or inefficiency in that than there would be in reproducing the property.

Mr. Wray pointed out that there had been a greater range in fluctuations between the price of 50 pair cable between 1911 and 1923 than there had been on 900 pair, and that there had been different rates of variation between the cost of that kind

of cable in between the two dates, and by reason of that dispersion in price, as he calls it, it has introduced an error into our weighting factors. I have just shown that the error is practically negligible, but it might be interesting to point out that the greatest difference that Mr. Wray showed was between 50 pair and 900 pair. As a matter of fact, there was
only 2½ per cent of 50 pair cable in the underground sys-
2247 tem. Two and one-half per cent of total dollars in under-
ground cable represents 50 pair cable. The actual variation in price is different from the variation in metal prices that Mr. Wray quoted in his testimony. The range of 51 pair cable between 1911 and 1923 would be 61.50 to 100—assuming it was $100 in 1923 it would be $61.50 in 1911. The range on 900 pair cable was from 66⅔ to 100. So you can see that even it introduces no error in the index factors.

I obtained my allowance for omissions and contingencies in connection with the Byllesby and Arnold appraisal in the following way. By reference to Plaintiff's Exhibit 1 you will
find that the total amount of dollars in the Byllesby and
2248 Arnold appraisal, raised to the 1923 level was $41,427,-
357. I have taken that figure split up into accounts and subtracted the total plant retirements by accounts from the figures contained in the Byllesby and Arnold appraisal. In many cases the retirements were considerably in excess of the total amount shown in the Byllesby and Arnold appraisal. In that case, the account was considered as wiped out and carried forward as zero. After making that deduction, I had a residue of $18,357,462, which is probably understating the residue of the plant that was appraised by the Byllesby and Arnold appraisal, because some of the retirements that had been taken out in that period were undoubtedly plant that had been erected after 1911. Three per cent, which is the allowance for omissions and contingencies, amounts to $551,264, as shown in my report.

Cross-Examination by Mr. Haight.

Referring to Plaintiff's Exhibit 50; column 1, refers
2249 to the method that I actually testified about on my direct examination and the method from which I obtained my results in finding reproduction new costs. I selected the accounts 241, 242, and 245 because there was a segregation of material and labor costs in reference to those accounts appearing upon the books of the Company. There are no other accounts appearing upon the Company's books in which such segregation appears between labor and material costs that could be used in a test of this sort. Account 241 is exchange pole lines, 242 exchange aerial cable, and 245 exchange underground cable.

In column 2 of Plaintiff's Exhibit 50 I have taken ten spe-
cific estimates for each year for the period from 1914 to
2250 1923. I think there were one or two years when we could not get ten, but broadly speaking we got ten. In some cases we got one or two or three less.

My assistants did most of the work, under my supervision, of preparing the material from which I got the deductions that appear in column 2 of Plaintiff's Exhibit 50. The employes of the Illinois Bell Telephone Company assisted to this extent. We told them what we proposed to do and made inquiries as to what material was available and we received the assistance by reason of the fact that they put the material at our disposal and showed us the various sources from which the information could be obtained.

2251 The engineers or employes of the Illinois Bell Telephone Company did not have anything to do with the selection of the particular specific estimates that I chose for any of the years. As I recall, what we did was to take the ten largest. It is my understanding that in each instance we took the ten largest.

I cannot answer you definitely as to whether any facts were taken into consideration in making the selection as to the specific estimates used in any particular year other than the ele-

ment of their size. I think perhaps there may have been one or two instances where there were certain abnormal things shown in them, in the way of transfers from one account to another. I think perhaps there might have been some cases where they were thrown out, but there was no intention on our part to select anything that would not be typical. We made no conscious effort to try and distort the result in any way whatever. We made a very honest effort to really find out what the answer was. We either have those specific estimates in our possession or have the numbers so they can be referred to.

2252 Describing generally the ten specific estimates referred to, account 241 refers to poles, whatever kind of poles happened to be shown. It might have been poles with cross-arms or what not, as long as it was in account 241. Account 242 refers to aerial cable. We took the ten largest of that. Account 245 is the underground cable.

As you probably know, a specific estimate may cover, say, $100,000. A portion of that may be poles and a
2253 portion may be aerial cable, and a portion may be underground cable. For account 241, as I recall our procedure, it was to take the ten largest estimates where the pole portion was the largest. We really tried to get a typical and true answer to the question. Now, we may have made some slips—I don't know—but we tried to get it the best we could.

In column 2 in respect to the basis of labor weighting, I used the same method as in the appraisal method set forth in column 1; that is, I carried the same fixed gang through from year to year during the entire period. For account 241 in column 2 the figure $1,435,877, total gross additions, June 30, 1923 level, means that the total gross additions from 1914 to 1923 have been raised to the 1923 level by the method indicated in column 2; that is all of the exchange pole lines added to the Chicago plant of the Illinois Bell Telephone Company during the period 1914 up to June 30, 1923, is represented
2254 by a figure less than the $1,435,877, and this figure is the figure to which I raised the book cost of these various items from year to year throughout the period. That is, there

was a certain number of dollars shown on the books for gross additions to poles during that period. We applied these index factors, which were determined as described in column 2, and got the result of $1,435,877. The figures that we got during the same period by the method we used in our report (Plaintiff's Exhibit 1) is shown in column 1 as $1,427,274. That is, this second method gives six-tenths of one per cent higher than the method that we used.

The same method was followed in regard to account 242 and in regard to account 245. In regard to account 242, I selected the ten highest specific estimates during each year that
2255 related to exchange aerial cable. Before I make the definite statement that we selected the exchange aerial cable part that was the largest in each of the specific estimates, I would like to check it, but that is my impression of what we did. I would have to refer back, but I think that is what we did.

Taking column 3 headed "Based on all material installed under ten specific estimates each year" it is partially correct to say the difference in that column is that I have taken a different gang makeup for each year than has been employed in column 1 or 2. If you will notice the top portion of the heading of column 2, on material we only took from the ten specific estimates the same items that appeared in our cross section that was used in our report. For instance, suppose we did not take any 20 foot poles into our set up in making our index factors for material in our original report, then we correspondingly left out the 20 foot poles out of the ten specific estimates. If you will read that heading I think you will see that is correct.

2256 In column 2 I am confining myself to the same items and same materials that I used in column 1, while in column 3 we took all of the material items in the ten specific estimates and the gang makeups as they actually existed in that year. Column 3 differs from column 2 in that in column 2 we only selected those items of material which we had previously used in our index factor setup.

2257 What we did as to the gang makeup in column 3 is as follows: In analyzing our labor costs we got all of the people employed each year. We got all of the foremen and all of the linemen and all of the splicers, all of the helpers, truck drivers, and all the various types of labor and their specific rates for that year. Those were taken from a very elaborate analysis of the payroll. So in column 3 our set up is based on the average for the year; that is, there may have been five linemen to a foreman in 1914 and in 1917 there may have been six linemen to a foreman. We took that into account by analyzing the payroll for each year.

In respect to the labor weighting entering into this construction work, the difference between column 1 and column 3 is that in column 1 I assume a typical gang that I carry throughout each year of the entire period, while in column 3 I take each year and create for the purposes of my illustration a typical gang for each specific year, carrying that gang from the first of January to the 31st of December. That
2258 is the difference.

In column 4 I used the same method as column 3 in regard to the basis of my labor weighting. On material I included all the material, no matter what kind of an estimate it was put in on, appearing in each of these three several accounts, 241, 242, and 245. That is what Mr. Wray and Mr. Cummings said was the correct method. We have adopted it for three and one-half years to see what error it made.

2259 Plaintiff's Exhibit 51 covers the period from 1912 to 1923. The first column, "Book cost June 30, 1923," is what the books show as to each of these specific items listed in the accounts to the left on the exhibit.

As to the second column, under the heading "Work done under specific and work done under routine" let us take
2260 account 221, Central Office Equipment, for example. We took the total gross additions in that account from 1912 to 1923. Those gross additions may or may not have totaled the amounts shown on the books but it gave a sub-

stantial part of them. In most cases it was very close
2261 to the book cost. The book cost of that account is
$26,140,441. You will see that in the first column. Suppose that what we found was that the gross additions in the period from 1912 to 1923 amounted to $20,000,000. If that is correct then $18,580,000 would have been found as having been done under specific and the balance as having been done under routine. That is, we analyzed the $20,000,000 and saw what part of it was specific and what part of it was routine and then we applied those factors which are shown in columns 3 and 4 against the total.

We did not pick out the amount of central office telephone equipment appearing on each estimate. We took all the gross additions for that whole period from 1912 to 1923. Of
2262 course, we examined each estimate to see whether they were specific or routine. We simply classified them in two columns. If $100,000 was spent in one year under routine and half a million under specific, we just tabulated that in the two columns. That was a rather simple calculation. You are to understand exactly what Plaintiff's Exhibit 51 says—that 60.2 per cent was done under specific and 39.8 per cent was done under routine. Those figures appear opposite the word "totals" at the bottom of those columns.

The next heading, "Total excluding all station equipment," means we just leave the station equipment out. All of the accounts from 231 to 235 (Station Equipment) total $19,244,435. Those items, in my opinion, would be done under Mr. Wray's theory of reproduction, identically as they are
2263 being done now. I cannot conceive of that particular kind of work being done in any other way than it is being done now so we are excluding it. Then you will find 77 per cent is under specific and 22.8 under routine. The figure just above the last figures give what it is where it (Station Equipment) is left in. In the last line we have thrown it over into the specific cost. In my opinion, that is the way it would be done under Mr. Wray's so-called reproduction method.

2263½ *Re-direct Examination by Mr. Bangs.*

Mr. Bangs did not ask me to prepare these exhibits and so far as I know he saw them for the first time this morning. I do not recall that he saw them before that.

Re-Cross Examination by Mr. Haight.

2366 In working out Method 4, appearing on Plaintiff's Exhibit 50, I took all of the gross additions in the three accounts shown from March 1, 1920 to December 31, 1923. The reason I used that particular period was that during that time I found that the Company had kept a special record summarized by years, of the quantities under both routine and specific estimates. In fact, that is all of the quantities erected during those years. I made my studies from that special summary and not from the original records of the Company. I do not happen to know the purpose

2367 for which the record I refer to was kept. There was an accounting circular issued in February of 1920, and to the best of my knowledge it was sent out to all Bell operating companies to keep a record of all plant items erected. But the thing was discontinued at the end of 1923.

At first I did not take any steps to satisfy myself that the additions shown in the summary were the additions actually made to the plant as shown by the Company's books. When Mr. Cummings came over to our office he raised that question as to whether we had checked them back to the original field records. We sent over two men yesterday morning and checked a portion and found it to be correct. The reason we did not check it when we first took it was because it was a direct operating record of the Company and was taken in the ordinary procedure of business and was supposedly correct. The slight check I made yesterday indicated that it was correct. The check that was made this morning was just a spot check upon three items.

2368 To the best of my knowledge that summary showed material items only and did not show labor hours or dollars. Having compiled the quantities of the various items

that were placed each year, I then priced them out at average prices paid for such items during each year and also at the prices as of June 30, 1923. I then applied the supply expense percentages shown for each year on page 143 of Plaintiff's Exhibit 1 to the total of dollars com-
2369 puted in that way. Then from the total dollars thus computed at current prices and at 1923 prices, plus supply expenses, I computed the percentages of increase comparable to the percentages developed and used in Plaintiff's Exhibit 1.

For labor I ascertained from the payrolls of the Company for each year the average number of foremen, linemen, and groundmen; on exchange pole lines, for example, I took all of the foremen, linemen, and groundmen which I found on the payrolls, priced them out at the average wages, and
2370 from the totals of those extensions developed the percentages of increase in labor costs which I used for this account in Method 4, in Plaintiff's Exhibit 50. The same procedure was used in multiplying those percentages of increase in material prices and labor costs by the same percentages of material and labor that are used on pages 114 and 115 of Plaintiff's Exhibit 1, with the exception that we inserted the different quantities and different wage rates for the different gang formations in each year. I followed the same method in this Exhibit 50 that I did in Exhibit 1, and the same proportions of material and labor, but with different material and labor indices, which were developed in the manner I have described. Of course, we took the total material from this record I have described and we also took the relation of labor to material as shown by the records. I assume that those were checked with a reasonable degree of accuracy.

In computing the labor index used in Plaintiff's Exhibit 50, I did not ascertain what proportion of the time of those linemen and groundmen was devoted to construction work.
2371 The general average of those wages would be the same, or approximately the same, whether they were maintenance or construction. We simply took the rates to get

the dispersion of different kinds of labor as occurred in each year. As a matter of fact, a considerable part of their time is charged to maintenance as repair and maintenance work. We assumed that similar gangs would place aerial and underground cable. We would need splicers for the aerial cable work. We estimated the number of splicers for aerial cable work at 40% of the number of linemen and groundmen, and for underground cable at 171.4 per
2372 cent.

I have the sheet on which I show the percentage of increase in labor costs in account 241. The number of linemen in 1911 was 122; the number of groundmen 135, making a total of 257. On the corresponding sheet for aerial cable I show the same number of linemen and groundmen.
2373 By taking 40 per cent of this figure I would then assume 103 splicers for this account. On the corresponding sheet for underground cable I showed the same number of linemen and groundmen, and by taking 171.4 per cent of that number I would assume 441.36 splicers for that account. These 257 linemen and groundmen are the same in all three cases. They do all sorts of work.

2374 If I had made similar studies of the other accounts I think I would have found these same linemen and groundmen stringing aerial wire. I don't think I would have found these same men working on toll plant. I am not sure about that.

If we add the aerial and underground splicers for 1911 we get a total of 544.36, which is the sum of 103 and the 441.36. In other words, I estimated twice as many splicers in the aerial and underground cable accounts as there are linemen and groundmen in all accounts, including pole lines and aerial wire. Putting it in another way, in this study I deal with the total workmen instead of typical gangs for each account. We tried to get as great a dispersion
2375 as far as possible of the possible lineup of labor in order to satisfy the criticisms of Mr. Wray and Mr. Cummings.

I don't think I could tell you the number of men engaged on exchange pole lines, on exchange aerial cable, on exchange aerial wire, and on exchange underground cable, but I do know for the period of 1920 to 1923 the number of hours charged to splicing and to placing, etc. As a matter of fact the thing checks substantially with the figures given as to the relation of the number of splicers as to linemen and groundmen. No splicers are used on pole lines. We haven't made any such assumption, as you well know. I haven't the data here to show the proportion of linemen and groundmen actually used in the gangs during the working of these accounts, meaning by that, poles as distinguished from cable.

2376 I do not know how much of the time of these 257 linemen and groundmen was spent on construction work and how much on maintenance. I will say that I regard the weighting I have used in this study as between linemen and groundmen, splicers, etc., as very representative of the Company's actual gang makeup in each of these construction accounts during each of the years. I can say that just from my general knowledge of the telephone business. I do know considerable about the general makeup of gangs for different types of construction, and for the years 1920 to 1923 I have a record of the number of hours as to placing and splicing, etc. I did not make up any typical gang for this par-

2377 ticular study.

My study under Method 4 is limited to the period beginning March 1, 1920 and ending December 31, 1923. The proportion of fine wire cable, 900 pair, 1200 pair cable, etc., placed during that period was substantially greater than in 1911, the time of the Byllesby & Arnold appraisal, and greater than in the gross additions during 1911 and 1912. I don't think they were using that kind of cable at all at that time. The greater part of the fine wire cable, 900 pair, 1200 pair, etc., which was in the plant on June 30, 1923 was placed during the latter part of the period from 1911 to 1923. I have forgotten just what year the fine wire cable was de-

2378 veloped but it was in the latter part of that period. I would say the larger part of it would probably be during that part of the study from 1920 to 1923.

I haven't made a calculation with reference to Plaintiff's Exhibit 50, using the basis of material weighting as in Method 1, and the basis of labor weighting as in Method 3. I would want to make it to answer definitely what the result would be. I don't think it would affect it greatly. I don't think that if my computations in Exhibit 50 had been carried out to two more places, mathematically speaking, my check might have been exact.

Re-direct Examination by Mr. Bangs.

2379 As near as I can tell, this cross examination was to break down the statement that I made that the average set-up of material and gangs we have used has not introduced any serious factor in my results. In my opinion it has not. I don't think it would serve any useful purpose to make any further calculations suggested by Mr. Haight in order to demonstrate the reasonableness of my result. I am willing to make them in any manner they want.

2380 One of the curves on Plaintiff's Exhibit 44-A was prepared in our office. I first saw the comparison of Mr. Turner's curve with my curve the latter part of last week.

2868 (Mr. Bangs states that he is advised by Mr. Sloan that Mr. Sloan does not think it is reasonable or necessary for him to add anything for the Court's information on the subject or to make any further study as suggested by Mr. Wray and Mr. Cummings).

Re-cross Examination by Mr. Haight.

2869 I will agree that any of the accounts in my Exhibit 50 is fair to use as an example. We will use Exchange Underground cable. In Exhibit 1, page 125, I have used a cross section of all material in the plant as of 1923. This cross section includes among other items, 1212 pair 24 gauge, 101 pair, 202 pair and 303 pair 19 gauge. Then I applied through all the years 1911 to 1923 the respective material costs to those and the rest of the items. The costs of this fixed

bill of material for each year were then added and a supply expense then applied. These totals were then converted to percentages using 1923 as the base year. These percentages of increase in material prices were used in conjunction with my increase of labor price percentages to produce my
2870 composite figure. The percentages of increase in material prices were separate for each year and related only to 1923 as a base. Thus there is no relation between the separate years except that each has 1923 as the base.

In Exhibit 1, page 125, I include material costs for 101 pair, 202 pair and 303 pair, 19 gauge cable. In my working papers in connection with my preparation of Exhibit 50, I have indicated no 19 gauge cable installed under large estimates in 1920. In my proof test of column 2 I do not in the 1920 quantities include 19 gauge cable. The figure I get as my composite in Exhibit 1 for 1920 page 117 for underground cable is 14.81 (red figure) and the figure obtained using the largest specific estimates is 16.13 (red figure). This gives a variation of about 1.3 per cent in my per cent
2871 increase and is a fairly close check.

The figures Mr. Haight has given have apparently been computed erroneously. If we had omitted the 19 gauge cable from our fixed bill of material the total material cost for 1920 would be $72.30 instead of $67.17. The total material cost exclusive of 19 gauge cable as of June 30, 1923, is $60.44. When translated into percent increase for June 30, 1923 over previous periods, this results in a decrease
2872 of 16.40 per cent to compare with the per cent decrease used in our report of 16.01 per cent or a difference of .39 per cent.

In my fixed bill of material I include 1212 pair 24 gauge cable. (Exhibit 1, page 125). This is the same as saying that the 1212 pair cable affects in each year the per cent increase June 30, 1923 over each year. There was little or no 1212 pair cable placed in the plant until 1918.

2806 WILLIAM J. HAGENAH, called as a witness on behalf of the plaintiff, in rebuttal, having been first duly sworn, testified:

Direct Examination by Mr. Bangs.

My name is William J. Hagenah; business address, Chicago; residence address, Glencoe, Illinois. I was a member of the firm of Hagenah & Ericson during its entire history, when Mr. Erickson was in private practice in Chicago.

2807 The business of that firm was specializing in the making of appraisals, cost analyses, and rate studies for all classes of public utilities, on behalf of corporations, public service commissions, municipalities, and taxing bodies.

I began making investigations of public utility properties in the autumn of 1903, in the state of Wisconsin, by employment by the then governor, and continued in that work for four years, when the Railroad Commission of Wisconsin was organized, and I was then appointed its first expert in rates and on economic problems of regulation. I was with the Railroad Commission of Wisconsin for four years. I then engaged in private practice in the city of Chicago from 1911 until August, 1928, when I gave up my private practice.

I have made appraisals in forty-two different states of the United States, a number of provinces in Canada, several sections of Mexico, West Indies and in South America. The approximate value of the properties that I have appraised, including some that were appraised the second time after

2808 intervals of eight or ten years, aggregates nearly four billion dollars. I have appraised many telephone companies, including Detroit, Cleveland, Birmingham, and various properties in Brazil, also for State-Wide Investigations in West Virginia, Virginia, Maryland, Vermont, and Ohio. In most of those cases on behalf of the public service commissions. I testified both for the public utility and for the commission. In those state-wide cases, with the exception of Vermont, I was especially employed by the public service commissions.

I made an affidavit in the case here on trial on the motion for temporary injunction on or about the 17th day of September, 1923. At that time, or prior thereto, I made an examination of an appraisal of the physical property of the Illinois Bell Telephone Company located in Chicago, which was made by Mr. Sloan as of June 30, 1923. As a re-
2809 sult of my examination, I arrived at an opinion as to the method of the appraisal and the results obtained. I made an examination of the report that Mr. Sloan had prepared, checking his methods and his sources of information, the progress of his work, and his conclusions, and arrived at the opinion that the result of his investigation fairly set forth the approximate then value of the property.

Mr. Sloan's appraisal was based on a detailed inventory and appraisal made of the Chicago Telephone Company's property in 1911 by the firm of H. M. Byllesby & Company and B. J. Arnold. Shortly after that appraisal was completed, in 1912, I made an analysis of the methods entering into that report and was quite familiar with it.

Mr. Sloan took that appraisal as a basis for 1911 and seeking to establish the approximate value of the property in 1923, he analyzed the then costs of construction, and by the application of factors raised the Byllesby & Arnold appraisal from the 1911 to the 1923 price level. He then made
2810 studies of the construction costs of the Chicago Telephone Company for each of the years of 1912 to 1923 and brought forward the construction for those years to the 1923 price level by the application of factors and index numbers.

He also analyzed the retirements of property during the period from 1911 to 1923, raised the retirements to the 1923 price level, and then deducted them from the total that he had reached for the gross company property in 1923, his result being the then net value of the property.

I have read the abstract of testimony given by Mr. Wray in this case. I have an opinion on Mr. Wray's criticism that Mr. Sloan's appraisal was a method of piece-meal construc-

tion and therefore would not show a true reproduction cost of the property as of June 30, 1923. The criticism made by Mr. Wray does not apply to a property of the extent and magnitude of the Chicago Telephone Company. It would ap-

ply in the case of a smaller property. I have myself
2811 checked Mr. Sloan's appraisal of other properties where

a somewhat similar method was used, and have made the same criticism of it when dealing with very small properties. The Chicago Telephone Company is, however, such a large property that its average annual expenditures for construction are even as large as some of the large telephone properties of the United States. Consequently, the annual construction of that company is anything but piece-meal construction and involves all the problems which are present in large continuous construction undertakings.

As to the criticism that Mr. Sloan's method did not give full effect to any variation in efficiency of labor, I think his method does give effect in a practical way to the efficiency that had developed in the construction art. By relating his valuation findings for the different years to the basis of 1923, he did give effect to the efficiency that obtained in the tele-

phone construction work at that time. That was the
2812 basis on which he was appraising the property.

The physical conditions obtaining in Chicago in 1923 would, in my judgment, entail a larger construction cost than that which would be reached by applying index numbers or factors to the actual construction expenditures made in prior years. That is due to the fact that the city of Chicago has grown very rapidly. It was in 1923 a much larger city with more involved construction conditions than were present in the preceding years, and much more involved than were present in the early years of construction. That is especially true because of the increased congestion in the streets and large amount of public utility construction work underground that would have to be disturbed or around which construction would have to be made at great expense, if the property were to be constructed under 1923 physical conditions. I am fa-

miliar with the situation in the loop so far as public
2813 utility property is concerned. I have for six years been very intimately connected with a detailed survey of all underground construction work in the city of Chicago, involving the making of a survey of every utility property, including every pipe line, every water, sewage, or gas underground conduit for every utility company, its exact location in the streets and its location with respect to the property of every other company. The amount of utility construction in the streets of Chicago is simply amazing. Figures have been taken in connection with such work wherever street openings have been made.

The situation is such today that if utilities were to make a general construction in the streets of Chicago the cost would be so largely in excess of what anyone could estimate that I doubt whether a construction contract could be made on anything but a cost plus basis. The physical conditions underground become obvious when one knows how many times gas pipes and water pipes go directly through manholes, how many times manholes and catch basins are built on special steel and concrete construction over the construction work of other public utilities. There are many places where steel
beams, arches of steel and brick and concrete are made
2814 to protect properties of other utilities in the street. For example, when a conduit line was built down LaSalle street in 1917 or 1918, I personally inspected a good deal of that work and it was necessary to suspend, by chains from the tripods over the street, construction work of other utilities to enable the Telephone Company to get its conduit in the proper place. In a number of instances, it was necessary to handle the dirt two or three times. The men had to get down on their knees with small tools working out the dirt around existing construction and yet making protective construction devices to hold up these lines from cracking and bending. The dirt would be handled from one platform to another before finally placed on the street. All this makes for exceedingly heavy construction costs and those conditions

are not given full weight, nor reflected in the index numbers as compiled by Mr. Sloan when he applies them to construction undertakings that were actually entered on the books of the company in prior years.

Cross-Examination by Mr. Haight.

2815 I quit the practice of my profession in the fall of 1928. I am now vice-president of the Byllesby Engineering and Management Corporation of Chicago. That company is engaged in the construction and operation and financing of public utility properties.

I examined Mr. Sloan's appraisal, to which I have referred, in 1923, and I made one previous examination in the summer of 1922, but most of my study was in 1923. I have made an examination since, but only in a casual way. I have had a copy of his report. I think the last time I saw it was about 1927, several years ago. In 1927 I read it over and
2816 checked some of his figures to acquaint myself with the method that he had used. I think I prepared some affidavits involving the company's property at that time. I also used some of his data as a check on appraisal work I was making of other telephone property. I don't think the examination I made in 1927 covered all the same material that I examined in 1923. The data I examined was from the same appraisal. The only examination I have made since 1923 was a casual examination, but I made a thorough examination in 1923. I believe the examination I made in 1923 referred to the same items of property as did the appraisal of
2817 which I made a casual examination in 1927. I don't remember the details of it. I think I covered the major accounts in each case.

I do not remember whether in the appraisal of which I made a casual examination in 1927, Mr. Sloan made the same choice of particular kinds of property in the various accounts that he did in the appraisal that I examined in 1923. That choice would not make any difference in my opinion in respect to the appraisal, because I base my answers on the examination

that I made in 1923, and my use of it, reference to it, at a later date, was merely in connection with my general practice. I was under the impression in 1923 that I was going to take part in this case; I prepared myself quite thoroughly but other engagements made it impossible. I have since dismissed the matter from my mind and did not even know that the case was pending until recently.

In the appraisals I made over recent years, up until I discontinued the practice in 1928, I have not had any one
2818 single method, but I have adapted myself to conditions present in each case. I have in some instances made detailed reports and appraisals from field examinations. I have in other cases made studies from the records and books of the company. In some instances I used other methods. I came to my conclusions from each method or one or the other and have been influenced by the conditions present in each case in shaping my final judgment as to the fair value of the property. Mr. Haight has the affidavit about which I was interrogated on my direct examination and which was signed by me on September 17, 1923.

2819 I consider, speaking generally and not with reference to any particular telephone property, but speaking of telephone properties generally in the United States, that the average life is approximately twenty years. It may vary several years in either direction, depending upon the physical characteristics of the particular plant. I mean by that
2820 that is the composite life. I consider an inventory made in 1911, with the changes occurring in the plant from then until 1923, a sufficient basis for an appraisal without making any further inventory. I think it furnishes one good evidence of value. An inventory more nearly related in time to 1923 than 1911 would be helpful but not conclusive. It would not be preferable, in the case of a company that keeps the elaborate set of accounts that the subsidiaries of the American Telephone and Telegraph Company do. I would say it is an even proposition. I think I could work out a satisfactory appraisal on either basis. In cases of some com-

panies that do not keep records well I would not place much reliance on their books.

2821 If the question of time and money was entirely eliminated, I would prefer having an inventory, but I would not stop with an inventory. I would supplement it with analysis of construction cost. I have never made an appraisal without such supplement. Where I could not have a detailed inventory, I proceeded on the books and made a detailed inventory of parts of the property, if I had time to do it.

2822 I never base my judgment on one evidence of value alone. If the cost of one method was the same as the cost of the other method, I would use one or both and I would want to see both, one to supplement the other. Neither is conclusive.

I have never made a detailed inventory of the Illinois Bell Telephone Company's property located in Chicago. I made a valuation or appraisal finding of this property in 1910 and 1911. I never operated a telephone property. I never personally constructed a telephone property.

In making my examination of Mr. Sloan's appraisal in 1923 I took the source of his figures. I went back to the books of the Chicago Telephone Company with certified accountants in my employ. I did not go back to the books in respect to all items used by Mr. Sloan. I made random checks. I imagine I went back to less books than Mr. Sloan. Mr.

2823 Sloan has been a long time on it and my work was completed in a few months, about three or four months.

The conduit in LaSalle street I mentioned was about 1917. It may have been a year later. I don't remember the cost of installing that conduit. I have had it.

The cases of the workmen moving the dirt three times instead of one, was a detail supporting the general assumption that the cost of construction was enormously greater in 1923 than in prior years. That was my evidence of the cost. I did know what those costs were. I do not have them in mind now. It was very important that I knew what they were at that time.

I examined the books of the company to ascertain the substantial accuracy of the amounts that Mr. Sloan said had
2824 been retired. That was ascertained by my accountants from the company's plant accounts and reserve accounts.

By piece-meal construction I mean the construction of properties in isolated instances that border very largely maintenance with betterments involved, and for small extensions, what the telephone company in its business regards as routine estimate work, involving amounts in some companies under $2,500 and in other companies as low as $1,000. Now if you want to build your unit costs, or composite, developed from all of the detached, isolated, scattered jobs, you would get a unit cost that I think would be wrong. If you put in $10,000 worth of poles somewhere, ordinarily that would be for a specific estimate. That is not the only fact I would want to know to determine whether it was piece-meal construction or not. In a good many instances the $10,000 might be spent in the setting of a very small number of poles and shifting
2825 the wires and the cables connected therewith. One must exercise intelligent judgment in the selection of estimates upon which unit costs are to be based. I don't think I would assume that $10,000 was all one job or a plurality of jobs and very much scattered. I have had enough experience to know that a $10,000 job would involve a variety of conditions. Before I would rely on that cost I would acquaint myself with the conditions. That is where the trouble comes in in making any kind of valuation. You can get any result by the figures selected, but if you want a fair answer as an experienced man is going to make you would want—the kind of an answer you would make would be very largely dependent upon the kind of an estimate you select. An intelligent engineer selects the estimates that apply to the kind of work he is trying to study.

2826 I have made studies and checks of parts of the Chicago property of the Illinois Bell Telephone Company on a number of occasions in connection with financing. I made a report. I do not care to go into the details of it. I think

it would be regarded as confidential by Mr. Sunny. It was made for him personally in connection with financing the company. The report was never published. I think that was about 1915 or 1916.

(Mr. Bangs states he thinks it was 1920.)

I have made checks of parts of the property at different times. I made some study in 1920 and I have been given access to the company's books through the courtesy of the officials to verify cost data that I was using in connection with other appraisals. I am quite familiar with the company's business for a period of 17 or 18 years.

2827 Before answering whether in making an appraisal of the telephone company's property I take into account the changes in efficiency of labor, I would want to know what you mean by efficiency in labor. My answer can only be generally in the affirmative. The term efficiency of labor is used in two senses. One as to the honest application of a man who is doing his work. The other is changes in productivity which do not involve the element of performance.

If you are dealing merely with honesty of application of effort, then I would say that we must take that into consideration specially. If you are dealing with increased productivity of labor and improved performance, you get that directly from an analysis of the books and records of the company, which reflect whatever conditions are present in the organization. If you accept the costs as they stand in 1919 and merely make a change in each item entering into the composite cost to reflect the increase or decrease to 1923 you are not giving effect to changes in the honesty of application of effort but you

2828 are giving effect to the changes in the art of performance. Now, except for possibly a few disturbances that occurred during the War period, labor has not been inefficient and there has been less inefficiency in the public utility business than in any other industry. It is a negligible factor at best in the public utility business. Changes in method have had a greater effect than the attitude of mind of the employes. In the utility business there was not several years prior to

1923 when labor efficiency was very low. There was no particular change in it. There was little construction of telephone property during those periods except War emergency matters. The staffs were reduced because of the reduced construction work and the call for military duties. The younger men left, the older men remained. In some instances I found that because of the very much higher experience and age of the men that remained, the efficiency was even greater during the years of the War on the work then constructed than it had been before or since.

2829 I do not consider that Mr. Sloan's method has given the reproduction cost new as of June 30, 1923, as we ordinarily use that term in an engineering study based upon an actual inventory, and then setting up a theoretical construction gang, labor performance, material cost and all the direct and indirect related overhead charges. As an evidence of the fair value of the property, it is just as good as any appraisal that can be made, because there is no evidence of value that can be made 100 per cent right.

I could not describe Mr. Sloan's method any different than what he does in his own affidavit. It is a method that is more or less relied on as a check of other evidences of value. I have used it more or less as a supporting evidence of value, perhaps in some score of cases. I have used it otherwise than as a check. I have in quite a number of cases, where again I must resort to the matter of cost and time. Those items were considerably more than zero and the situa-

2830 tion did not admit of taking the time and incurring the expense of making the appraisal. That is more frequently used in appraising property values for purposes of financing, ascertaining the equity in securities, and I have applied that method in determining the value of securities for investment of trust funds by banks, and I used it very largely in the appraisement of telephone properties in foreign countries where, because of the different currency and the element of exchange, it would be very expensive to make a detailed inventory and appraisal.

In a utility rate case I think I gave somewhat more weight to it than as a check in the appraisal of the telephone properties in West Virginia and also in Maryland and I made use of it to some extent in Ohio. In all three cases I was on the side of the public and was opposed to Mr. Sloan. I took his method and checked it back, and where we made the check on properties located in small cities or small exchange areas, I would say that the method is not entitled to as much weight as a direct inventory and appraisal, but where we made the check on such large properties as the Cincinnati Bell property, or in Cleveland or Baltimore, our independent checks came so close together that it was practically an agree-
2831 ment, and this being a large property I would attach more weight to the result obtained from such a study.

The names of the three cases are the Chesapeake & Potomac Telephone Company of West Virginia, the Chesapeake & Potomac Telephone Company of Baltimore and Ohio Bell Telephone Company. Mr. Sloan in those cases went to the books of the company and obtained estimates of construction involving larger units. I obtained access to the same information that he had and in some instances went farther. I checked his method to enable me to pass judgment on his appraisal result and also to influence my judgment in arriving at fair values as affected by my own reproduction cost appraisal. It was a bridge between the two appraisals and verified the reproduction cost against the actual book cost of property brought down to the present price level or the then present price level.

2832 The West Virginia case was in 1924, the Maryland case in 1925 and the Ohio case in 1927. All three were cases before commissions. I did not make an inventory in any of those cases. Mr. Sloan made one partly from a field check and partly from the books of the company, which were in each case submitted to me, checked by my own engineers and their accuracy verified. That was true in all three of those cases. I might also add to that, the Cincinnati Bell Telephone case, which never really went before the Ohio com-

mission because it was settled. Mr. Sloan represented the company and I represented the city of Cincinnati.

It may be that in the more crowded districts per unit of cost you oftentimes get many more stations in than you do out in the outlying districts. I am not concerned with that.

2833 I am talking about the value of the property in place, or cost of putting it there. Obviously you have more stations in the loop with millions of dollars of capital than out in the far West. It is just a matter of opinion whether you have more stations in the loop per unit of investment than you would in outlying districts. In a hotel and office building district compared with scattered residential, individual house districts—in the last districts, you would not have so many telephones there and your construction is much simpler. It is all above the ground.

Re-direct Examination by Mr. Bangs.

2834 If you wanted a real detailed inventory and appraisal of the Chicago exchange in 1923 I imagine it would cost not less than $225,000 and might cost $75,000 more than that, depending on the inventory difficulties that might be encountered and how much assistance you would get from the company. It would take about two years to make it with a staff of over 100 men. There might be a bill for extras at the end, depending on conditions. I would protect myself against that. I don't know what you would encounter if you tried to measure up property in the city, but these appraisals
2835 run pretty close to $2,000 for a million of metropolitan construction, and it runs considerably more than that where the record is involved and there is not complete co-operation between the company and the municipal authorities, because the attitude of the municipal authorities is also important in making an appraisal for the company.

JOHN R. TURNER, recalled as a witness on behalf of the plaintiff in rebuttal, testified:

Direct Examination by Mr. Bangs.

My name is John R. Turner and I testified for the plaintiff in this case. I prepared Plaintiff's Exhibit 44 for identification.

Plaintiff's Exhibit 44 shows a curve embodying the cost index numbers of the composite telephone plant in the
2264 City of Chicago, exclusive of land and buildings, relative to the base year of 1914. 1914 has been given a value of 100 and all subsequent years have been determined relative to that number.

It is part of my regular duties in the company to determine the trend of costs usually expressed in index numbers periodically. This particular exhibit was taken from those figures which have not been prepared for this case but are used for various purposes. The quantities of plant in each account have been determined by an analysis of the actual plant in service as of December 31, 1922, from which we found the kinds of materials and the relative quantities. As an exception to that is the case of a few items of property which have been studied by other means.

The Central Office equipment was taken from the records of the Traffic Department, which showed the total equipment of all kinds and types in the City of Chicago as of June 30, 1923, and the particular weighting of it was made in connection with the Chicago Rate Case originally. The station apparatus has no running inventory of the different types and quantities by types so that in order to get at the
2265 proper weighting of the various kinds of materials used in station apparatus, we examined all of the deliveries made during the twelve months period ending June 30, 1923.

In that manner we determined the relative quantities of each kind of material entering into each account. This study was made separately by classes of property expressed in accounts. The average yearly prices of materials based on

our material price lists were determined for each of the items included in our studies and these prices extended by those quantities so that we were able to determine a total material price for the composite material in each account for each year from 1914 down to date. From these total material prices we have determined the cost changes expressed in index numbers. In other words, we have compared all subsequent years with 1914 in order to determine the percentage change in the composite material price for these representative items in each account.

I did not take all the items in the account but simply took what I considered to be representative items. I think
2266 in all cases we have taken enough items, all of the representative items of the large quantities, and enough of the smaller quantities to furnish a very accurate indication of cost changes. This selection of items was not made for the purpose of preparing testimony for rate litigation, but was made in connection with my ordinary duties.

A similar method was employed in determining labor index numbers for those accounts where labor was considered as a separate entity. That is particularly true of the outside plant.

In 1922 at my request a conference was called of the construction supervisors and some data was presented in connection with the various gang makeups that were used in connection with the construction work in Chicago. As I recall it there was some variation in the gangs in accordance with the particular project they might be working on, but after giving consideration to those variations for the year we determined upon what I believe was a very representative gang organization indicative of the average for the year. That was what we were trying to get at—the average labor cost for a year. On the basis of this gang makeup an exam-
2267 ination of the average monthly wages paid the various classes of workmen was made and from that the average annual wages for each class of workmen was determined. This then was weighted together in accordance with this

typical gang, each class of workmen getting the relative weighting that was indicated by the gang organization.

In addition to that the annual percentage of supervision and tool expense incurred in each of these years was included in the gang wage so that the total labor cost for the typical gang for each account was determined for each year from 1914 down to date and a comparison between those subsequent years and 1914 furnished a labor cost index,—furnished an index of the wages paid the labor. There was some question about efficiency in regard to these workmen that I will discuss a little later.

I would like to say at this time that there are certain accounts where it is possible to study the cost in place of material, that is the material prices, the indirect charges (plant supervision and tool expense) and the cost of installa-
2268 tion. That was true in the case of central office equipment. There we were able to analyze completed estimates and get a percentage relation of the labor cost in each year to the material prices, and that was applied to the material prices in this index study.

Similarly, the station installations account was obtained from the records of the Company as a cost in place per new installation. That is a record that is permanently maintained in the Accounting Department and readily available. There is some little work in getting it, but it is accessible.

The composite index numbers for the accounts that were studied separately as between material and labor, were based on the material index and labor index combined on the basis of the efficiency or labor performance of 1926. Those were outside plant accounts. That is, just the outside plant
2269 accounts were combined in that manner. I will have to explain the others.

There is a complete study of the specific estimates of 1926 available from which we made a study of the unit costs. These unit costs, by the way, were used as a tentative basis in determining retirement unit costs and, of course, in the determination of unit costs it is necessary to deal with material and

labor separately. Now, the labor analysis was made on the basis of man hours for the year 1926 and labor cost built up from that basis. The material unit costs were simply a matter of applying material prices and allowing for supply expense. These material unit costs were applied to the quantities of plant as of December 31, 1922, and the total unit costs, that is the unit costs including material and labor, were also applied, the material portion thus being ascertained.

As I have already explained, in the case of central office equipment and station installations, the index numbers were derived from the cost in place including labor and associated costs in each year. Station apparatus involves material
2270 and supplies expense only. There is no labor charge in the station apparatus account except such labor as might get into the supply expense, which is the cost of obtaining and delivering that material.

The labor cost of installing private branch exchanges was determined from an analysis of some seventeen hundred odd installations in the city of Chicago, I think in the year 1925. From that analysis we determined the average time per installation for the various types of Boards. The labor cost of booths was estimated, I think it was a matter of two hours for booths, and the variation of labor costs there would be so negligible that no particular effort was made to make other than the estimate of the men who were doing that work.

These composite index numbers I have been describing were, for convenience, plotted in the form of a curve relative to 1914, as shown by Plaintiff's Exhibit 44 and they show that the maximum price in the city of Chicago was in 1921 when the index reached 206 or 106 per cent increase over the average for the year 1914.

2271 I have testified as to the stability of prices from 1923 to 1925. This curve will show that prices from the year 1922 to 1925 have been practically stable. The actual figures were in 1922 index 182; 1923 index 182; 1924 index 183; 1925 index 183.

With reference to how I arrived at the percentages of the various items of plant for the purpose of making this curve, the company has a running inventory of outside plant items which was summarized as of December 31, 1922, in connection with the determination of average retirement unit costs, which are average book costs. That record I think was originally established from the plant engineering records and show the major items of plant and their location on maps, some-
2272 what similar to that shown here by Mr. Sloan. These maps were summarized sometime prior to 1922 and from that time on a running inventory of plant quantities, that is the major units of outside plant, have been recorded by the plant accountants, that is for the outside plant.

As I explained, the central office equipment was taken from the record of the Traffic Department in connection with the Chicago Rate Case and shows in quite a considerable detail the quantities of jacks and cord circuits and switchboard frameworks and all the various units of central office equipment in considerable detail.

This curve shows the cost of the composite plant of the plaintiff in the City of Chicago, exclusive of land and buildings, from the year 1914 to 1925, based upon the labor efficiency of 1926 as to the outside plant. It reflects the
2273 efficiency of each year for the central office equipment and station installations, those two accounts. Station apparatus is just a material account, so there is no question of efficiency there. Private branch exchanges were based on a study of installation in 1925, therefore they reflect the efficiency of the year 1925. The booths were estimated along about 1923, and I don't believe that any change in efficiency there for labor would materially affect that. A booth may cost fifty or sixty dollars and the time to install it is about two hours.

(Plaintiff's Exhibit 44-A, marked for identification.)

Plaintiff's Exhibit 44-A is another chart showing the index numbers plotted in a manner similar to that shown on Plaintiff's Exhibit 44. The solid line marked "Turner index" is exactly the same line as shown in Plaintiff's Exhibit 44.

2274 Mr. Sloan did not determine the index numbers exactly. He determined factors of increase that would convert the actual costs of the previous years to the cost level of June 30, 1923. (Plaintiff's Exhibit 1.) I have simply reversed that policy, using his factors of increase starting with 1914 as a base equalling 100. I have shown by the broken line on Plaintiff's Exhibit 44-A the index numbers that I have derived from his factors of increase. That is purely a mathematical calculation.

One of the very interesting features of this curve is that Mr. Sloan carried forward to the year 1923 the relation of material and labor in each year at the time of the actual construction. In other words, the efficiency or what is probably more correct, the labor performance of the year in which the expenditures were made. I, on the other hand, have taken the efficiency at the end of this period, namely in 1926,
2275 and have maintained that labor performance relation throughout this entire curve. In spite of that fact, there is but little variation between the two curves. The cost changes shown by both Mr. Sloan and myself are very similar. With the exception of the year 1918, Mr. Sloan shows approximately the same increase in cost or a lower increase than I do.

(Plaintiff's Exhibit 44-B marked for identification.)

The broken line on Plaintiff's Exhibit 44-B is the same as in Plaintiff's Exhibit 44-A. The solid line in Plaintiff's Exhibit 44-B is the curve of index numbers presented in the statewide case of the Indiana Bell Telephone Company or
2276 before the Federal Court, which I understand was presented by Mr. B. G. Halsted, appraisal engineer of the Indiana Bell, and which is marked for identification as Plaintiff's Exhibit 36 in this case. I understood or rather the abstract of the record here shows that Mr. Wray has testified to this curve.

(Plaintiff's Exhibit 44-C marked for identification.)

Plaintiff's Exhibit 35 in this case shows two curves of index numbers made, as I understand it, by Mr. Cummings for Mr.

Wray, one of them in the New York City case and the other in the Indiana Bell. These curves have been transferred to Plaintiff's Exhibit 44-C on which the New York City index numbers are shown as the dotted line and the Indiana Bell
2277 as a dot dash line. These costs or index numbers of costs were taken for typical outside plant and according to the photostat of the original exhibits are based on the costs for exchange pole lines, exchange aerial cable, exchange aerial wire, and exchange underground cable.

I have taken from our own record of cost changes index numbers of those same accounts for the city of Chicago for the years 1914 to 1925 inclusive. The curves of J. G. Wray & Company are made on an arithmetical basis, as I understand it, so that I have plotted an arithmetical average of the experience in the city of Chicago, which is the solid line. I have also shown the correct weighting for these accounts in a dash line which follows somewhat the same shape as the arithmetical average; the arithmetical average, however, would be a more true comparison I think with the Wray curves.

(Plaintiff's Exhibit 44-D marked for identification.)

Plaintiff's Exhibit 44-D is the labor portion of the
2278 costs which I have just described for Plaintiff's Exhibit 44-C, except that there has been another curve added to this chart which was called "other companies, other telephone companies." These curves of Mr. Wray's were taken from Plaintiff's Exhibits 33 and 34. Now the comparable Illinois Bell experience in labor cost is shown with a solid line and the dash line and is, at least since 1917 substantially below the experience of these other companies as far as the cost relation to 1914 is concerned.

Plaintiff's Exhibit 44-E for identification shows in the solid line the experience of the Illinois Bell Telephone Company in the installation of central office equipment, central office telephone equipment in the City of Chicago from 1914 to 1925 inclusive. I have also plotted on this chart the cost
2279 changes in central office equipment in the New York Telephone Company as a dotted line and in the Indiana

Bell Telephone Company as a dash line. These were taken from Plaintiff's Exhibit 32. It will be noted here there is a very close approximation of the cost in all three locations except the Indiana Bell Telephone Company in 1922, which looks as though it was just the 1921 index number carried forward.

I don't know how the other curves were made up by Mr. Wray. I believe it is rather an easier proposition to make up an index curve on central office equipment. I think you can obtain information on it more readily and I am not in a position to state what may have caused Mr. Wray's deviation from my curves. I feel that my curves are correct for this company and I am not in a position to offer any
2280 reason for the deviation. Of course, in a weighted average curve there might be some variation due to the different compositions of the properties, that is a possibility, but you see we have taken an arithmetical average in some of these things and that should be comparable, I think, between the companies, with reasonable differences as to the character of the plant.

2873 *Cross-Examination by Mr. Goldstein.*

Referring to Plaintiff's Exhibit 44, I made up material index numbers for each account by weighting the average prices during each year on the basis of a list of material which was representative of the plant in service December 31, 1922. I ascertained the plant in service on December 31, 1922, from the plant accountant's running inventory for the major units of property and from the plant engineer's map records for minor items of property not included in the plant accountant's records.

The plant accountant's record of quantities was based on a summary of the plant engineer's field records which are constantly checked in connection with the engineering of plant extensions and replacements. Since the establishment of the plant accountant's inventory whenever plant engineering
2874 records are re-summarized, the plant accountant is furnished the summary as a check against his running in-

ventory. The plant accountant's records of outside plant quantities on December 31, 1922, was based on a summarization of the plant engineers records at the end of 1920 so that the period elapsed since the summarization of the quantities was only two years.

I determined the representative list of materials for each account by taking practically all of the items constituting an appreciable amount within the account in their actual relation to each other. The percentage of change in prices has not been the same for all items in each account. It is possible, for example, in the cable accounts, terminal prices may go up while cable goes down and vice versa. (Page 121, Exhibit 1). Some sizes of cable have gone up or down more than others.

2875 In order that my list may be representative for the purpose of making index numbers it is necessary that the weighted average of all these price changes up and down shall be the same as in the total plant. I have already explained how I obtained the representative weighting of quantities.

My list included an allowance for supply expenses. The percentages used for supply expense were as follows:

	Supply Expense.
1914	7.5
1915	10.4
1916	10.3
1917	9.1
1918	12.3
1919	9.3
1920	10.0
1921	11.0
1922	9.0
1923	7.5
1924	5.4
1925	4.42

2876 Those percentages did not include any purchasing charges paid the Western Electric Company to my knowledge, but I understand they did include some warehousing charges paid the Western Electric Company at least for some part of the period under consideration. I do not know how much was included in supply expenses for warhousing charges paid the Western Electric Company and it will probably require some time to determine this accurately. This information will be furnished as soon as it can be secured from the records. Mr. Sloan made up his list of representative items from the same record that I did.

In the case of central office equipment the record I used was as of June 30, 1923. For station apparatus I based my weighting on the deliveries made during the year ending June
2877 30, 1923. I think those deliveries are representative of the total plant in that account for the purpose of developing index numbers or cost trends.

In making up my labor index I used a typical gang which was representative of the company's practice in 1922 and it was the consensus of opinion among the construction supervisors responsible for the organization of these gangs that the gang make-up I have used based on the year 1922 is typical of the composite yearly gang in each of the years 1914 to 1925. Then I priced out that typical gang at the average wages paid each class of workmen during each year. I used the same typical gang for each year during the period covered by my study (1914-1925). The percentages used
2878 during each of the years 1914 to 1925 for supervision and tool expense in the exchange outside plant accounts were as follows:

Year.	Plant Supervision.	Tool Expense.
1914	10.8	2.2
1915	8.2	2.4
1916	7.5	2.3
1917	8.4	3.1
1918	9.2	2.3
1919	9.5	2.4
1920	10.4	2.4
1921	7.9	3.0
1922	6.2	3.1
1923	5.0	3.3
1924	7.41	3.45
1925	6.85	3.38

Those percentages were determined by the plant accountant by relating the supervisory and tool expense charges to the bare labor costs each month and expressing the relation in a percentage. The account numbers included in supervision and tool expense are plant supervision—supervision account 706--01, and tool expense account 703.

2879 In the case of central office equipment I determined the labor costs as a percentage of material prices. The percentage relation of installing cost to the cost of material varies to some extent with the size and type of the installation. I think the variation in this percentage is due more to the type of the material installed than to the size of the installation job.

We did not develop a percentage curve of the relation of installing cost to material cost for central office equipment, but we did develop the percentage relations shown by completed work arriving at an average for each year. In
2880 my opinion this method is satisfactory for the determination of cost index numbers showing the variation in such costs between years.

In respect to the outside plant accounts, the relation of material and labor costs to the total cost for outside plant were based on the labor performance of 1926. An analysis

of all completed work under specific estimates during the year 1926 was made to determine the labor performance expressed in man hours. Through the use of these man hours and the prevailing labor rates of pay in the year 1926, and the average material prices for the year 1926, and the average indirect charges, namely supply expense, plant supervision and tool expense for the year 1926, unit costs typical of the actual costs of material and labor in the year 1926 were developed. The application of these complete unit costs to the quantities of outside plant used in the index numbers produced a total cost for these items as of 1926. A similar extension of the material unit costs produced a result showing the mate-
2881 rial portion of this total cost and the difference between this and 100 percent represented the labor cost. This method was used in each of the outside plant accounts to determine the relation of material and labor in that year.

When I say the labor cost was built up on the basis of man hours for the year 1926, that means the actual average performance during that year as determined by proof testing trial units against our estimate records. That was the actual labor performance during 1926. For this proof test I used all specific estimates.

2882 I combined the material and labor indices for each year by converting the relations found for 1926 to the year in question by the ratio of cost change for material and labor respectively. My labor cost index is in fact an index of wage levels.

In my judgment, considering the gang make-up on a basis typical of a full year's performance, there is no measurement required for the variable of gang make-up. This is indicated to some extent in Plaintiff's Exhibit 44-D in which it will be noted that the experience of the Illinois Bell Telephone Company labor costs for typical outside plant construction shows practically no variation between the arithmetical average and a weighted average in spite of the fact that the gang
2883 make-up in the different accounts differs materially. For example, the aerial wire account is largely the labor

of station installers which is not included in any of the other accounts and the cable accounts include splicers and splicers' helpers and splicer foremen which classes of labor are not included in the other accounts.

In regard to the variables mentioned by Mr. Cummings as to the different proportion of labor cost to material cost for the different sizes of property units, this has been properly and fully reflected in our determination of the relation of material and labor to total cost in the year 1926 due to the fact that the actual labor performance and resulting cost was related to each size of property unit placed in that year. The fourth variable mentioned by Mr. Cummings was that of labor efficiency or output per man hour. That was accurately determined for the year 1926.

Labor efficiency, as it is commonly defined, is substantially what I term labor performance, in other words, through
2884 better organization, improved methods, improved tools, etc., an increase in the efficiency of labor may be accomplished; on the other hand, due to increasing difficulties in performing the work such as increased obstructions underground, a greater amount of paving to disturb or complicated aerial conditions to contend with, greater traffic, etc., the increased efficiency of labor may be more or less neutralized resulting in no increase in labor performance. We have not measured the variation of labor performance for each of the years for the period covered by these index numbers plotted in Plaintiff's Exhibit 44, but we have considered and discussed this question with supervisors closely associated with the construction work and feel that no substantial increase in labor performance occurred during the period under consideration, viewing the outside plant as a whole. I am of the opinion that in the underground conduit account, labor performance has not improved during this period, although admittedly there has been an increase in the efficiency of that labor. In other accounts, although there are increased difficulties, it is possible that some increase in efficiency has occurred.

2885 Based on Mr. Sloan's reproduction costs of the physical property exclusive of land and buildings, as shown on Plaintiff's Exhibit 1, page 2, last column of figures, 35 percent of the total reproduction cost is represented by central office telephone equipment and station installations in which labor efficiency has been measured. Station apparatus and other equipment of central offices representing 10 percent of Mr. Sloan's total reproduction cost involves material only so that no question of labor efficiency enters into its portion of the total cost. Of the remaining property, namely private branch exchanges, booths and special fittings, interior block wires and outside plant, according to my computations, about 21 percent of the total reproduction cost is represented by labor which has not been definitely measured as to the variation of labor performance. Assuming that labor performance had improved during this period, to as great an extent as 10 percent of the labor cost for these particular accounts, the effect on the total reproduction cost, exclusive of land and buildings, would be 2.1 percent. In my judgment, this represents an extremely exaggerated possibility of variation.

2886 Plaintiff's Exhibit 44-D indicated that the ratio of labor cost increase in the Illinois Bell Telephone Company is conservative and reasonable when compared with the experience of other companies as shown in this exhibit.

In arriving at the general composite shown in Plaintiff's Exhibit 44, the index numbers for the individual accounts were composited into a single index representative of the entire property, exclusive of land and buildings, in accordance with the percentage relation of the reproduction cost new as determined by Mr. Sloan and shown in Plaintiff's Exhibit 1, page 2. In respect to outside plant, my index is based upon the labor efficiency of 1926. In respect to central office equipment and station installations on the efficiency of each year. In respect to private branch exchanges on the efficiency of 1925, and in respect to booths and special fittings, on the efficiency of 1923.

Referring to Plaintiff's Exhibit 44-A, in converting
2887 Mr. Sloan's factors of increase into the usual index
form, I did that by accounts. I weighted out the indices by accounts to obtain the composite shown in Exhibit 44-A in the same manner as that described for the index numbers used in the curve shown in Plaintiff's Exhibit 44 as previously explained. Without going into mathematical details, what I did in converting Mr. Sloan's factors of increase into the usual index form was substantially the same thing that Mr. Cummings did in City's Exhibit 95 in converting Mr. Sloan's factors of increase in material prices in Column 1 to the usual index form in Column 2, and his factors of increase in labor cost to the usual index form in Column 8.

I heretofore testified "One of the very interesting features of this curve is that Mr. Sloan carries forward to the year
1923 the relation of material and labor in each year at the
time of the actual construction. In other words, the
2888 efficiency or what is probably more correct, the labor
performance of the year in which the expenditures were made."

Mr. Sloan's labor index was made up by the same method as mine, by pricing out a typical gang at the average wages current during each year. The answer I have given in regard to my own index numbers to the question whether it makes any allowance for changes in any of the variables referred to by Mr. Cummings except wages will, I think, apply to Mr. Sloan's computations, except that Mr. Sloan has determined the relative labor performance for each year which may, in a measure, more properly reflect the changing efficiency in regard to the gross additions for that year, if any changes occurred. In my testimony, which I have just quoted, what I meant was simply that in compositing Mr. Sloan's material and labor indices into a construction cost index, he weighted them out on the basis of the relation of
labor and material in each year at the time of the actual
2889 construction.

In Plaintiff's Exhibit 44-C, the solid line is the arithmetical average and the dashed line the weighted aver-

age of my indices for the four accounts of exchange pole lines, aerial cables, aerial wire and underground cable. In 1918 they differed by about 15 points. That difference is due entirely to the difference in weighting. The weighted average of these four accounts might differ to some extent with different Companies, due to the different proportions represented by each account relative to the total, but the arithmetical average should not differ between Companies. I assume that it was for the purpose of eliminating that difference that Mr. Wray used an arithmetical average.
2890 I have set up my arithmetical average for the same reason.

Taking the index for any one account, that is a weighted average of the changes in all the various units in that account. The weighted average length or class of pole, the weighted average size of cable, etc., would not necessarily differ rather substantially as between different Companies. My opinion in regard to this is that the comparison between the City of New York and Chicago should be somewhat comparable in all of the accounts shown by this Exhibit. Between Chicago and Indiana I think it is possible that the average height of poles in Chicago would exceed that in Indiana. I would not expect any substantial difference in the average size of aerial cables between Chicago and Indiana. There is the possibility that the average size underground cable in Chicago is somewhat in excess of that used in Indiana.
2891 Where I have indicated the possible difference in the average size of property, it is possible that some difference in the index numbers would result.

It appears that the spread between Mr. Wray's curves and mine in Plaintiff's Exhibit 44-C, is due probably to a large extent to the greater labor cost increases shown in his curves plotted on Plaintiff's Exhibit 44-D. In Exhibit 44-D when I distinguish between an arithmetical average and a weighted average I refer to the weighting as between the various accounts and not the weighting within each account. My indices shown in this Exhibit are indices of wage levels computed in the manner I have described.

2892 I am not aware of the fact that Mr. Wray's indices for New York City and Indiana, which I have plotted in Plaintiff's Exhibit 44-D, are indices of labor cost which make full allowance for all the variables testified to by Mr. Cummings. Assuming that to be the fact, I would not consider that these curves were comparable. If Mr. Wray's curves of labor cost indices reflect a decrease in the labor performance, and it may be assumed that the same condition is applicable to the Chicago labor experience, I should say that our labor costs would be higher, and as a result our cost index numbers for more recent years should also be higher, and in that event, it is quite likely that the reproduction cost found for outside plant by Mr. Sloan should be increased similarly, as it is my understanding that he did not reflect a decrease in labor performance in his computations.

2280 FREDERICK L. RHODES, having been duly sworn as a witness in rebuttal on behalf of the plaintiff, testified:

Direct Examination by Mr. Bangs.

2281 My name is Frederick L. Rhodes. I live in Short Hills, New Jersey. My office is at 195 Broadway, New York City. I am Outside Plant Development Engineer of the American Telephone and Telegraph Company and have been with that company thirty-seven years. I have been in my present position since 1919. From 1909 to 1919 I was Outside Plant Engineer.

As Outside Plant Development Engineer I am responsible for studying the needs of the Associated Companies of the Bell System in respect to their present and future requirements for the apparatus and materials used in the outside plant, and directing a program of research and development in order that we shall have ready to recommend to the Associated Companies for their use apparatus that has been thoroughly tested and tried out before the growth of
2282 the companies has brought them to a position where some system or piece of apparatus beyond what they now have available will be required to meet their needs. As Outside Plant Engineer I was responsible for that and also for consulting engineering advice on specific engineering problems brought to our staff by the engineers of the Associated Companies. The work of the staff grew to such an extent that by 1919 it was deemed advisable to split the department which had been the Engineering Department of the American Telephone and Telegraph Company into two departments, one Operation and Engineering and the other Development and Research, and at that time I went into the Department of Development and Research.

The general staff of the American Company is the organization which it maintains to conduct research and development in all branches of the telephone business to advance the telephone art and to furnish advisory and consulting services to the Associated Companies of the Bell System

in every phase of the telephone business. I have been attached to the staff for thirty-seven years.

2283 (Plaintiff's Exhibit 53 marked for identification)

I can describe the organization of the general staff department of the American Telephone and Telegraph Company by means of the diagram marked for identification as Plaintiff's Exhibit 53. Under the President are several departments indicated by name on this diagram, each in charge of a vice president. At the left is the Legal Department; general legal matters under the direction of the General Solicitor; general patent matters under the General Patent Attorney; matters relating to taxes under the Tax Attorney, and there is another attorney who has to do with documents connected with bond issues and such.

The department of operations is divided under three vice presidents, Mr. Cooper, Mr. Gherardi and Mr. Hall. The section under Mr. Cooper has to do with studying the
2284 commercial possibilities of new types of telephone service such as photo-telegraphy and radio matters in connection with the telephone service. Mr. Cox, Assistant Vice President in that department, follows the relations between the associated companies and the Western Electric Company to make sure that the benefits to the associated companies are being fully realized.

The section under Vice President Gherardi I have covered in another organization diagram, so I will pass over that for the moment.

The section under Vice President Hall has to do with personnel matters, producing the greatest amount of cooperation within the system, securing a personnel that is satisfied with employment in the Bell System and interested in its progress and ideals.

Another section has to do with the Medical and Benefit Department, and another one deals with relations to Colleges and Universities in seeking new personnel for the system. The Department of Accounts and Finance is also under Vice President Cooper. I might mention in that connec-

tion that in an organization as large as this which
2285 comprises over 2,500 people, that it is necessary to have a co-ordinating vice president who will consider the viewpoints of the various departments that may be concerned in the same question, and line them up before the matter comes up before the president for discussion and decision. In 1923 this department had about 1,800 people.

The Accounting Department advises and assists Associated Companies in accounting and statistical matters and develops methods and principles and records.

As I have a diagram of the department of Development and Research in more detail, I will pass that.

Under Vice President Wilson is an assistant—Mr. Wilson himself has the function of representing the president as a substitute in interviews and discussions with organizations like Trade Associations; it is necessary to have a high official who can substitute for the president whose time would otherwise be very largely taken up.

Then there is the Information Department under Mr.
2286 Page. Mr. Page is a well known man in literary and newspaper circles and was formerly editor of World's Work. He, with the department under him, advises and assists the Associated Companies in their publicity work and conducts the national advertising of the system.

That leaves only Mr. Ellsworth who has to do with the office organization of the president and the secretary who has the usual functions of an official of that kind. All of these various gentlemen report to the president. Those that are shown directly down the line report to the president and those shown on the second line report to those above them. I have another chart showing the details of the department of Operations.

2287 (Plaintiff's Exhibit 54 marked for identification).

Plaintiff's Exhibit 54 shows the organization of the Department of Operation and Engineering. It consists of seven sheets numbered consecutively from chart 1 to chart 7 inclusive. The first sheet shows the people who report

directly to the vice president in charge of the department; and the figure beneath the man's name shows the number of people reporting to him. It shows that there are three principal men: Assistant Vice President Waterson, who has charge of Plant Operations and Traffic Work; Acting Plant Engineer Harrison, who has a series of men representing different Plant Operations; Commercial Engineer Wilson, who also has a similar considerable number of department heads reporting to him.

This does not have anything to do with the long lines. The long lines of the American Company is operated practically as a separate company. There is a general manager in charge and they have an engineering department of their own of something like 150 people. Their relation to the staff is calling on the staff for advisory and consulting work in the same way the Associated Companies do. This tes-
2288 timony about the organization eliminates the Long Lines Department. The Long Lines Department makes a license contract payment the same as the Associated Companies and they get license contract services. The
2289 Long Lines Department is not a separate corporation from the American Telephone and Telegraph Company. It is an operating division.

I do not believe it is necessary to go over these charts in detail because they speak for themselves, but they not only give the number of people and the personnel in these departments but opposite each name is the title which shows the work that that specific man or group of men is doing and it gives the nature, scope, and diversity of the work performed in that department. I have a similar chart for the department of Development and Research.

2290 (Plaintiff's Exhibit 55 marked for identification).

2291 Plaintiff's Exhibit 55 referring to the organization of the Department of Development and Research, consists of six separate charts. Chart No. 1 shows the organization of those who are in charge of the work and the succeeding sheets show the detail of each department under those in

charge. At the head of this department of development and research is Dr. F. B. Jewett, vice-president of the American
Company, who is also president of the Bell Telephone
2292 Laboratories, in order to bring about the closest possible coordination between the work of these two organizations.

Under Vice-President Jewett is a section of the department having to do with the Central Office engineering and development; another section with the outside plant; another with transmission development and electrical interference; an engineer who has to do with the working out of methods for keeping telephone lines free from electrical disturbances; a research engineer, and a representative in Europe, who is a resident in London, and whose purpose is to keep in touch with scientific developments in Europe and bring to the attention of the staff anything that is going on there that may be of interest and value in telephone developments in America.

Dr. Jewett, the head of this department, is one of the best known scientific leaders in this country, a man of international reputation, and one of the foremost electrical scientists in the world.

(Plaintiff's Exhibit 56 marked for identification.)

2293 I prepared Plaintiff's Exhibit 56. This is a diagram intended to show the scope and extent of the general staff services by functions and kinds of work rather than by personnel. It takes up each department of the general staff and beneath it in organization diagram form it gives brief statements of the principal classes of work performed by this central organization. I think that with that brief explanation Plaintiff's Exhibit 56 is probably self-explanatory.

I might say that the general staff is an organization of specialists. Through the size of the staff we are able to
2294 keep a specialist on every point in the telephone business, whose duty it is to be thoroughly familiar with his specialty, to do whatever work can be done to advance it, to keep in touch with his specialty in its application to the plants and work of the associated companies, to be a thoroughly

qualified expert along those lines and to have his information always available on call for the officials of the associated companies.

In the briefest possible words, the operation of a telephone is this: When one speaks in the air he sets up waves of condensation and rarefication which travel out through the air. When he speaks through the telephone those waves strike the diaphragm of the telephone transmitter, where they are transformed into electrical waves of the same shape and form and frequency as the acoustic waves in the air. A telephonic message is transmitted over the wire by these electrical waves; and at the receiving end of the line the receiver transforms these electrical waves back into acoustic waves of the same shape and form and frequency as the waves set up in the air by the voice of the speaker.

2295 The amounts of energy that are employed in telephoning are the smallest of those in any form of electrical application with which the public comes into contact. The energy expended in an ordinary telephone conversation in the telephone receiver is about one two-millionths of the energy expended in an ordinary 16 candle power electric lamp. The efficiency of the telephone receiver is very great with very minute currents, so that an audible sound will be produced in the telephone receiver by an amount of energy which is only one one-millionth of the one two-millionths of the 16 candle power light. I think that gives a measure of the extreme delicacy of the telephonic apparatus.

I have made a study of the early state of the art of the telephone business. The telephonic art, as we understand it, began with the invention of Alexander Graham Bell. At first the telephone was regarded as a toy. All that came from Bell in the beginning was the fundamental principle of telephony and the receiver in its original crude form.

I have brought with me a reproduction of the first tel-
2296 ephone through which speech sounds were transmitted.

In the very beginning a crude form of liquid transmitter and a harmonic reed receiver and a few feet of wire con-

necting them from one room to another constituted the entire telephone plant in the world. There were no microphone transmitters, no switchboards, none of the thousands of parts that are now essential to a completely operative telephone system. The business began commercially by licensing firms and individuals under the Bell patents, and these firms and individuals started to operate telephone exchanges. They were confronted with very serious physical problems. The telephone lines were noisy; what was said over one circuit could be heard over another and when a telephone wire paralleled a telegraph wire, the noise of the telegraph very seriously interfered with the telephonic conversation. These licensees brought their troubles to the licensor company, and it undertook to advise them as to the best means for overcoming these troubles. The licensor company continued Bell's laboratory with his assistant, Thomas A. Watson, in charge.

Professors of Physics were retained to advise as to how to overcome these troubles. They knew more than most anyone at the time about electrical principles, but it was in the
2297 youth of electricity and the fundamental principles themselves were not clearly understood, even by those who were most skilled. But this small aggregation of specialists undertook to advise the licensees as to how to overcome their troubles and to develop the telephonic art.

Looking back, it seems that there might have been three ways in which the telephonic art could have been developed.

Each one of these licensee companies, acting by itself, might have retained technical specialists, chemists, physicists, mathematicians, metallurgists, designers, and all of the complicated force necessary to solve the problems. If that had been done it seems to me that no one of these companies would have been in a position to have employed a sufficiently large force of specialists to have accomplished very much, and there would certainly have been a great deal of duplication between the licensee companies.

This results from the fact that the telephonic art has always, from its beginning, been in a state of development and

progress. The instrumentalities of one era have not been adequate to meet the demands of a following era in the business.

2298 The second would have been for each of these companies to have done nothing to advance the art, but to have hoped there would always be someone somewhere who would be in a position to sell to it something which it could use to advantage in its business.

The railroads have been operated to a considerable extent the second way. If this way had been in effect for the telephone business, the developments would have been made by those outside of the business, who were less familiar with the problems and requirements than those within, and it would have resulted in important patents having originated in the hands of those outside of the business.

The third way was for these licensees to employ an organization which would be working all the time for all of them to solve these problems which could best be handled and solved by centralized organization, in this way avoiding duplication of work. It is that method which has been followed in the development of the telephonic art and I think one need look for its justification no further than to consider the state of the telephonic art in America compared with the corresponding conditions in other parts of the world.

2299 The general staff functions and always has functioned in developing the technical side of the art, in the sense of advising. It is our job to study the problems of the associated companies in the field and to develop and have ready the apparatus which they need, to furnish them with standards, and, in special problems, to advise them as to the best solution, but we exercise no superiority of power over these companies.

I have read the license contract but I am more familiar with the services than I am with the contract itself. The services of the general nature described in the license contract have been furnished to the associated companies, including the Illinois Bell, ever since my connection with the

business, which began 37 years ago. They were relatively elementary at the beginning and I have seen in my official lifetime the services extend and broaden out very greatly.

2300 The license contract is in general use throughout the Bell System. It is my recollection that there are about nineteen of these contracts. Two of them are in effect with companies the stock of which is not owned to the extent of voting control by the American Company. One of these companies is the Southern New England Telephone Company which operates in the entire state of Connecticut with assets of about 60 million dollars; the other is the Cincinnati & Suburban Bell Telephone Company, which operates in the City of Cincinnati and the immediately surrounding territory, with assets of about 30 million dollars. There is a license contract in effect with the Bell Telephone Company of Canada and that is a minority company.

2301 I have knowledge of specific services that have been rendered and are being rendered by the American Company to the Illinois Company.

The bundle of wires that I have here is what we, in the telephone business, call a loading coil. A photograph of that appears on the right hand side of the picture marked for identification as Plaintiff's Exhibit 57. This coil is at present in use and came into use in the early part of 1927. The form of coil in use prior to that is shown on the left hand side of Plaintiff's Exhibit 57.

2302 Those coils are introduced in telephone circuits, largely in telephone circuits in cable, for the purpose of making small wires talk as well as large wires without the coils would talk. For instance, a circuit composed of two wires, each wire weighing 20 pounds per mile, will, when equipped with loading coils placed at intervals of about 6,000 feet, talk as well as would a circuit composed of wires each 150 pounds to the mile which do not have these coils connected to it.

There are many of these coils used in the Chicago Exchange in the inter-office trunk lines. By that I mean, the circuits

that connect different Central Offices. They are not at the present time generally used in sub-station lines, that is, the lines which connect subscribers' stations with the Central Offices.

To tell the story of the development of this coil I shall have to go back as a starting point to the year 1900.
2303 Prior to that time it was known to those who were skilled in the telephonic art that if a telephone circuit could have the electrical property known as "Uniformly Distributed Inductance" increased, the circuit would become a better conductor for telephone currents; but there was no way of increasing this uniformly distributed inductance which would not bring in defects and objections which would be fatal to its practical application. Attempts had been made from time to time to simulate the effect of increasing the uniformly distributed inductance by lumping the inductance, in coils, but the attempts had been unsuccessful.

About 1900 it was discovered practically simultaneously by Professor Pupin of Columbia University, and by Dr. G. A. Campbell, of the staff of the American Company, that the path to success lay in spacing these lumps of inductance, or loading coils as they are now called, along the telephone circuit in the proper relation to the length of the electrical wave, and it was in the spacing of the coils that the key to the solution lay.

Patent applications were filed by Professor Pupin and by Doctor Campbell and they came into interference in the United States Patent Office, and the case was tried and decided
2304 by examiners in chief that Professor Pupin's date of disclosure was 14 days prior to Dr. Campbell's date of conception. The American Company purchased Professor Pupin's applications. They covered the principle of loading; but at that time they did not know how to make coils that would be capable of introducing into the circuits and obtaining the theoretical benefits of loading without containing within themselves losses that would largely, if not fully, neutralize the theoretical benefits from loading; and a group

of some of our most highly trained technical men on the staff undertook the development of satisfactory loading coils.

The type of loading coil which they produced and which was placed in service first in 1904, is represented by these models which I have before me. This (indicating) is a half of the loading coil; it is sawed on a diameter; the coil consists of a core of very fine iron wires and over this core are placed two windings of larger insulated wire. Each one of these windings is connected into one wire of the telephone circuit. This core contains about 10 miles of very fine iron wire; it is actually four one-thousandths of an inch in diameter. The purple color that you see comes from the fact that each one of these wires has to be insulated from the others, so that induced electrical currents will not flow
2305 through the core. The purple color results from a lacquer which is applied to the wires.

Now, at the time we were doing this work there was no iron wire possessing the proper magnetic qualities which was available in these small sizes. The first wire we obtained I remember cost $36 a pound, and we worked with wire manufacturers and finally brought the cost down to 60c a pound.

Now, various forms of loading coils of that general type were designed and produced and the next substantial advance came into actual commercial use in the year 1916. It was quite a radically different type of coil. The core instead of consisting of this very fine iron wire consisted of seven discs, which look as though they were made of iron or steel; the external appearance of the coil wound on this core was much the same as the external appearance of the number 508 which preceded it. The change was, as I have said, in the nature of the core. Now, the rings of which this core is composed are made of extremely fine particles of iron dust. In order to get the iron of the requisite purity, it is deposited electrolytically on cathode plates and then it is stripped off these plates and broken into pieces about an inch square and ground to a fine powder in a mill. Then these particles of iron
2306 dust are coated with a shellac mixture and compressed into these rings under a pressure of about 200,000 pounds

to the square inch. It is very easy to show that these rings are not solid metal but are compressed with this power. You can take one in your hands if you wish and break it. It requires very little force. (The witness broke one of the rings.)

Now, this improvement not only resulted in coils of more uniform impedance and greater magnetic stability, but this improvement in 1916 came at a time when the supply of loading coils to the associated companies was seriously threatened by the great war in Europe. That came about through the fact that the fine wire we had used before that time was drawn through dies which were small holes in diamonds and those dies came from the war zone in Europe, and the supply of them was cut off by the war; so this new process of making loading coils, which had been started before that time, relieved the situation by permitting the manufacture of the coils to go on continuously despite the war, and it enabled us to turn out the loading cables that were necessary to meet the growth of the business and in many cases the cable
2307 connections to be made to cantonments in a less expensive way than would have been the case if loading coils had not been available.

Then in the latter part of 1924 by improved processes in manufacture, it became possible to make a coil the core of which was a single ring pressed up out of this iron dust and the coil itself was, as is apparent by looking at it, the number 601 coil, smaller and very much cheaper than the types of coils which were used before.

(Photograph of coils 574 and 601 marked for identification as Plaintiff's Exhibit 58.)

I think I have already said something about the 602 coil which had a core consisting of two rings, and the first loading coil which you showed me was the 612, and I think it is worth while to say a little something about that. That, it is evident, is very much smaller than the early loading coils and the improvement which enabled it to be made smaller, without sacrifice of efficiency, was due to the discovery of a new magnetic material in the Bell Telephone Laboratories.

The material was the invention of Mr. Elmen in the laboratories. It is an alloy of about 80 per cent nickel and
2308 20 per cent iron, specially heat treated, and it has magnetic properties enormously superior to any form of iron which was available for use in loading coil cores before that time. The net result of all this improvement has been this: The art of loading has been extended to cables containing finer and finer wires; this 612 loading coil is used largely in connection with wires of 24 and 22 gauge; its cost when enclosed in iron pots by the hundreds, as they are used in their introduction into the telephone plant, has been reduced to very nearly a quarter of the cost of the type of loading coil which was used in 1904.

Now, there is another benefit that flows from the decreased size of the loading coil: These pots of loading coils in cities are placed in manholes, and with the old type of loading coil the pots were of considerable size and as the plant grew the manholes became crowded; the question of available space to place these pots became a serious one; the smaller size of the 612 and the series of which it is a type, has enabled very much smaller pots to be used for a given number of coils and the space in manholes has been correspondingly conserved.

2309 I do not know how many of these loading coils the Illinois Bell uses, but the estimated number that will be required to be manufactured during the year 1929 for the entire Bell System is about 1,800,000. More than half of them are used in long toll cable. The rest are used in exchange, inter-office transmission.

As to whether it would be possible to give telephone service in a large municipality without the use of this coil, I don't like to say that anything is impossible, but I think I can point out what would happen if we did not have the loading coils; instead of having cables containing large numbers of pairs of wires, as, for instance, containing 900 pairs for example, of 22 gauge, and 450 pairs of 19 gauge, we would have to have a great many trunk cables, which would contain per-

haps about 40 or 50 pairs of No. 13 gauge wires, perhaps 80 pairs of No. 16 gauge wires. Now, that would mean that perhaps ten times as many underground conduits would be
2310 necessary in conduit runs in the streets to care for these cables and the expense of the cables per circuit mile would be very much greater. This new permalloy is a patented article.

With reference to the patent situation, I would like to say at the beginning that telephony did not become a free for all art on the expiration of the Bell patents, and some of the earlier patents—telephony is a highly patented art and even at the present time there are approximately three telephone patents issuing for every one that expires.

Now, the American Company undertakes to obtain such patent rights as are necessary to afford a free field for the use of the best instrumentalities and systems by the associated companies of the Bell System. The associated companies themselves are required to give no attention to patent matters. The Illinois Company, for example, has nobody on its staff who is giving any consideration or concern to patent matters. The general staff attempts to make available for the associated companies the best there is in telephony
2311 from whatever source it may come, and if there are any patent rights outside of the system, we seek to acquire them. The American Company also undertakes to defend the associated companies from any patent suits that arise.

Now, groups of these patents which are held centrally in the Bell System, cover not only the instrumentalities which the associated companies are using at the present time, but there are groups of them which cover the paths that we must travel in the future improvement of the business.

The early part of this year the American Company owned or controlled, or was licensed under about 9,800 United States patents and there were about 2,000 applications pending. I do not recall offhand how many there were in 1923, but the number has been growing continuously.

The patents cover broadly the instruments. By that I mean the transmitters and receivers. A group of them applies to this subject of loading coils; another group applies to what we call transmission; for instance, there is a group of
2312 them that apply to the quadded cables that are used for bringing toll lines into cities. There very, very many of them applying to central office switching systems, and in fact, it would be difficult to mention any branch of the physical plant to which there are not certain patents that cover the instrumentalities either that we are using or that we expect to use in the future.

I might say that our purpose in acquiring these patents is not to prevent anyone else from using them, but to acquire such rights as we need to give us a free field in our development so that we will never be obliged to recommend to the associated companies anything which is less good than the best, on account of there being some outstanding patent right which would be infringed; and in pursuance of this policy among the patents to which I have referred are many under which the American Company hold a non-exclusive license for itself and its licensees.

2313 In the very earliest days in the telephone business, by that I mean in the period beginning about 1879 and including the early eighties the wires were generally run either on very tall poles in the streets or on frame structures on house tops. The only cables that were available at that time were those that had been used in telegraph practice. These cables had wires insulated with rubber or gutta percha and it was soon found that those cables, although they were very effective for telegraph work, were not well suited for telephony. The sound of the voice when carried over these cables was muffled and it sounded as though the speaker's voice was coming out of a barrel.

The early improvements in cables for telephonic pur-
2314 poses consisted in using as an insulating material, cotton, and the earliest cotton insulated cables had the cotton impregnated with an insulating and moisture resisting compound.

Passing rapidly over that period, it was about 1890 when it began to be appreciated that dry paper was the best insulating material for wires in telephone cables; that it gives the wires the desirable electrical properties to enable the voice to be transmitted clearly. Cables insulated with dry paper, of course, had to be placed within a metallic sheath which was hermetically sealed to resist the entrance of moisture. In the first forms of paper insulated cables it was practicable to place within a metallic sheath, about 50 pairs of wires.

Now the development work of the general staff aided by the engineers of the Western Electric Company and later the engineers of the Bell Telephone Laboratories has been directed towards increasing the number of wires which can be placed within a cable sheath of given size. This has accomplished two things; it has conserved space in under-
2315 ground ducts by enabling many more wires to be placed within one duct, and, by decreasing the cost of cable conductors it has brought down the cost of wire facilities to the associated companies very materially.

Now the ability to use smaller and smaller wires in cables has not resulted wholly from improvements in the design of the cable itself, but it has also been the result of improvements made in apparatus all along the line, better transmitters and receivers and central office apparatus, involving less transmission loss, so that it has been possible to take advantage of these transmission improvements in various parts of the plant, to extend more and more the use of fine wires in cables and thus obtain plant economies which could not otherwise have been obtainable. The result of this work of improving the design of cables so as to place more and more wires within a given sheath is shown by an exhibit which I have showing for various dates in the past, the maximum number of wires that it is possible to place within a cable sheath of given size and the size of the wires themselves.

2316 (Plaintiff's Exhibit 59 marked for identification.)

I think that Plaintiff's Exhibit 59 speaks for itself

without any explanation. I have another exhibit which goes with it which gives an idea of the economic importance of this

(Plaintiff's Exhibit 60 marked for identification.)

Plaintiff's Exhibit 60 is designed to show what these improvements in cables have meant economically. It shows on the horizontal scale at the bottom, the years from 1888 to 1928; on the vertical scale at the left it shows the first cost of a mile of pair, two wires in the cable, the cable completely installed and including the cost of the ducts.

Now, in the upper left hand corner is a horizontal line
2317 marked number 18 gauge, 50 pair. That cable corresponds to the one appearing in the upper left hand corner of the cross sections on the previous exhibit. The pair of wires in that cable cost more than $150 a mile.

Then starting in 1892 it shows in a jagged line the way in which the cost of a pair-mile of wires came down as more and more wires were placed within a given sheath. Below that is a similar line showing the decrease in cost with the increased number of pairs of 22 gauge wires and below that the number 24 gauge, 1212 pair cable. I might mention that the number 19 gauge wires are about 35/1000 of an inch in diameter and weigh about 20 pounds to the mile; 22 gauge wires are about 25/1000 of an inch in diameter and weigh 10 pounds to the mile; 24 gauge wires in the 1200 pair cable are about 20/1000 of an inch in diameter and weigh about 6½ pounds to the mile.

Now I should also like to say that the problem of increasing the number of wires in the cable is not solely a problem of the mechanical compression of these wires with their paper insulations; that there are electrical properties which
2318 have to be observed and conserved. It is necessary that the electro-static capacity should be considered; it is necessary that the cables should have certain dielectric strength, that is, ability to carry a certain electric potential without the insulation breaking down, and it is all the time necessary that the paper insulation should be permanent be-

cause if it should carry within itself some material which would produce the seeds of its own decay the result would be a calamity in the cable plants of the associated companies.

The way in which the cable wires are insulated with paper can be seen by examining what I have here which is a piece of 1200 pair cable. Each wire in that cable is insulated with a little strip of paper which is about 2½ thousandths of an inch thick and from a quarter to five-sixteenths of an inch wide. Now those wires are placed within a sheath which is about 2⅝ of an inch in outside diameter.

We have recently recommended as one of our standards to the Associated Companies for their use where they
2319 find that it is advantageous to employ it, a new type of cable which is not shown on the previous two exhibits which contains 1818 pairs of wires, number 26 gauge. In size, that is still the small wire, wire that weighs about 4 pounds to the mile. It is suited for use in inter-office trunks between offices that are not separated by a very great distance and it is used in numerous station lines from central offices to very large office buildings which may contain two or three thousand telephones.

Referring to Exhibit 59, the reason why there are so many less pairs in the No. 19 cable, 455 pairs than in the 1212 pair cable, both shown in the lower right hand corner, is that the 19 gauge wire has much larger diameter. The 24 gauge wire in the 1212 pair cable is a very much finer wire.

I might go on to say that the space in the pipe is filled with three substances. It is filled with copper in the wires, it is filled with paper which is the insulating material which sur-
rounds them, and it is filled with air which is in the in-
2320 terstices. Now, where it is necessary to employ 19 gauge, there is very much more copper in the cross section of the cable.

The cable is used for different purposes. The 19 gauge cable is used in long inter-office trunk lines and also used in very long subscribers' lines. The fundamental principle is

the larger the wire the better conductor it is for telephone currents, so the longer distance you have to talk over the larger the wire has to be to give a corresponding grade of transmission.

It is necessary at all times to make sure that the paper insulation on the wires of the cable is going to be permanent both in retaining its electrical properties and in not breaking down physically and allowing the wires to become crossed. The paper has to be subjected to very careful chemical tests and microscopic examinations to be sure that it is kept up to proper standards. There was a very interesting prob-
2321 lem that came up at the time of the war in connection with the paper insulation. We had always found that a suitable kind of paper for employing for insulation on these wires was made from old manila rope. The new manila papers did not make a satisfactory material. I mean, either new manila paper or fibre. Fibre didn't make satisfactory paper and the paper was not satisfactory for cable insulation. Now at the time of the war there was used old manila rope stock which came largely from the maritime cities of Europe. The supply was cut off and it was necessary to conserve and use very prudently the amounts of this old manila rope stock which were available. The way we had to do that, was to dilute this old manila fibre with other materials. We called into consultation one of the leading paper experts in the United States who gave us advice and then we immediately started a line of experiments with paper that was made by diluting the old manila paper with varying
2322 amounts of cotton and high grade chemical wood pulp. We conducted artificial aging tests on this paper and put some of it into experimental lengths of cable which were pulled in and out of ducts and the wires were spliced and the splices thrown from one group of conductor to another in order to give them a very severe treatment to see how they behaved. The result was that we were able to recommend to the Associated Companies the use of cable containing a dilution of manila pulp which enabled the supply to be continued.

There is some research development work being done now in connection with the use of paper on cable which is not yet protected by patent, but there is one phase of it that I would be very glad to describe.

There is work going on to see what can be done to lessen the amount of paper, to cheapen the cost of the paper and to enable still more pairs of wires to be placed within a given sheath, which is being brought about by a radical change
2323 in the method of manufacture of these cables. It looks to getting away from this method of insulating by means of a paper strip. In that method of construction the paper is manufactured and it is then split into tape, rolled up, and the tape is put in a machine and spiralled around a wire. Now we are quite well along on the proposition of a cable in which the paper is made on the conductor itself. That is, a wire is passed through paper pulp which is then dried on the wire, and it gives a continuous coating of paper pulp. I have a few samples that show the strip method of insulation and the pulp method, which samples are labeled.

There is development work going on at all times by the general staff that the Associated Companies know nothing about. It is a continuous process. We can't see where the end of the development and improvement and advancement in the telephone art is. It is certainly not within our
2324 sight yet. The history of the art has been one of constant change and we have hundreds of problems under way at the present time, all of which are important to a greater or lesser extent to the operation of the Associated Companies in the future.

There are two classes of developments that are useful that are brought to the attention of the Associated Companies. The first class would include the broader research developments which are initiated by the staff itself. This new method of applying paper to the wires is an example of that. This wouldn't be brought to the attention of the Associated Companies until it was practically completed and it has been within a few years, the last few years, when we have said, "Now

here are certain sizes of cable in which this new type of insulation is available and if you are so inclined you can order some of it and try it in your plant and see how it works and let us have your comments and criticisms on the way it handles." That is an example of one type which originates in the staff and proceeds out.

There is another type, one Associated Company from its experience may have some suggestion for improving
2325 something that was already in use, some tool or some piece of apparatus, and they say, why can't we have this done? It will do something more than it does now or do it easier. Requests of this character come to us through the Department of Operation and Engineering, and I should say there must be on an average perhaps ten or a dozen a week. It just isn't humanly possible to anticipate all these requests. For instance, they may find that some particular tool used in some particular way, might be improved. Now, if we had men who were going around all the time getting experience with that particular tool we could, but it would take our time from some of the larger and more important things.

In general, we do keep in touch with the field. I have a man in my department who is now on his way on a trip to the Pacific Coast and back, swinging around a large loop of
2326 the country, visiting all Associated Companies in regard to the guy anchors that are used for poles, to find out how certain types and sizes are working with them. When he comes back we will try to find from that experience—we will line that up with tests we have made ourselves on a great many of these guy anchors, actually planting them in soil and pulling them under a measured load to see how much load it takes to pull them out of the ground. We try to reduce the types and sizes as much as possible in the interest of the many advantages that flow from standardization. We then take that up with the Associated Companies to see if the advantages in them are sufficient from their standpoint to make them want to adopt that sort of standardization program.

From the early days of the business it was found that this metallic sheath which surrounds the cables would not be suffi-

ciently strong to withstand the wear and tear of operations if it were made of pure lead: it looks as though it were of pure lead, but for a great many years it was made of an
2327 an alloy of 97 per cent of lead and 3 per cent of tin which gave higher tensile strength than lead has and a better ability to withstand vibration to which aerial cable is subject.

As I say, that alloy was used successfully for a great many years. As the cables began to be used in increasing quantities, more and more by the Associated Companies, although only three per cent of tin was used, the amount of money being spent in the system for tin reached a large figure, so we undertook to see if we could develop an alloy that would be equally satisfactory with the 3 per cent of tin and cheaper. A wide range of alloys was studied in the laboratories, alloys of lead and antimony, lead and bismuth and ternary alloys, that is alloys of three elements, lead, tin and antimony, lead, copper and nickel and other combinations. These were all subjected to very careful laboratory tests for tensile strength, bending and in a specially devised machine their ability to withstand vibration. The most promising one turned out to be an alloy of 99 per cent of lead and 1 per cent of antimony.

Then cables were made in lengths of five or six hun-
2328 dred feet within a sheath of this alloy and we tested them in comparison with cables of similar size with the old alloy of 97 per cent of lead and 3 per cent of tin. These cables were subjected to pulling in and out, tests in difficult duct runs and to find out how many times the cables could be pulled in and out before the sheath failed. And we observed how some of these cables behaved when placed in pairs on an elevated railroad structure where they were subjected to very severe vibration: the place selected was where a branch line went into the main line of the elevated, so the motion of the trains caused the whole structure to sway very markedly and those cables were allowed to stay there for many months. After about five years work we reached the conclusion that it would be safe to employ the new allow in underground cables and it was so recommended to the Associated Com-

panies about 1912. We wanted to continue our vibration tests a little further, which we did for another year, and a year later, about 1913, we recommended the use of the new alloy for aerial cables.

2329 Now, following our advice the Associated Companies used the new alloy. If they had not used it and continued to use the three per cent of tin, the extra cost to the Associated Companies of the Bell System for the cables from that time to this, would have been more than $17,000,000.00,—that is $17,000,000.00 was saved in the cost of cable by the adoption of the new type of sheath.

I might say that we have work going on now which we hope may result in an even less expensive type of sheath, but that is not far enough along so that I would not want to talk very much about it yet. It is a hope and promise for the future, but we have got to do a great deal more work on it.

Development of carrier current is very fundamental. It is a very old problem in the telephone business, because from the very beginning telephone engineers have been trying

2330 to make telephone wires carry more messages, more than one message at a time. In fact, at the time that Alexander Graham Bell invented the telephone he was working on a telegraphic method of carrying more than one telegraph message over a single circuit. It was not, however, until 1918 that the engineers of the general staff working in co-operation with the engineers of the Western Electric Company, succeeded in transmitting simultaneously four messages over a pair of wires. That was due to the aid of two pieces of apparatus, the vacuum tube repeater and a device known as the electrical band-pass filter; that is a combination of capacities and inductances, which provided a device that is electrically transparent to a band of electro-frequency, and electrically opaque to all electro-frequencies above or below that band. Now by a process of modulating or mixing the telephone current with a high frequency current, which is called carrier current because it is only used transiently to carry the talk-

ing part of the telephone wave, it is possible to send
2331 four messages simultaneously over the same pair of
wires and by arranging four of these band-pass filters at the receiving end the telephone conversation which was combined with a particular high frequency would be picked off the line through that band-pass filter; the others would be rejected by it and in turn each be picked out by its own particular band-pass filter; then the carrier current was cancelled out and the talking current left on each one of these four terminals at the receiving end. That method is used now. I should like to say that when it was first developed, that the cost of the terminal apparatus was necessarily very high so that it only became economical to use this carrier current method on circuits more than 250 or 300 miles in length.

Now we kept working on the problem with the idea of reducing the cost of the terminal apparatus and it has worked out that we have been able to carry on two conversations
simultaneously over a pair of wires with terminal ap-
2332 paratus of such low cost that it becomes advantageous
to employ this method on circuits as short as 50 miles in length.

I am credibly informed that there are several of those installations in the territory of the Illinois Bell Company and several more scheduled for completion in 1929. The use of the phantom circuit was one of the first practical steps to increase the number of messages over a pair of wires. That, in the toll plant, made it possible to carry three telephone conversations over two pairs of wires simultaneously.

We have managed to incorporate phantom circuits in
2333 the cable. We call those cables, quadded cables. When
we were able to carry three conversations over two pairs of wires it became necessary to place those circuits in what are called toll entrance cables where they came into a large city. We had to employ three pairs of wires in the cable in connection with two pairs of wires on the open wire line, and it became evident that if we could apply the phantom principle to a cable and carry three conversations over two cir-

cuits in the cable that we would have increased the message carrying capacity of the cable by 50 per cent; but no way of doing that was known and we had to develop cable especially for that purpose with the pairs twisted in a peculiar and curious method in order to avoid capacity unbalance. First it was not possible to secure sufficiently well balanced
2334 cables and for a number of years a group of our people devoted themselves to improving the structure of the cable to increase its electrical balance. It became necessary where cables were installed in a plant to make unbalance tests so that by connecting consecutive lengths of the cable together with the pairs of wires picked out by the test it was able to have the unbalances in one section neutralize those in the adjacent section so the net result would give us a sufficiently well balanced circuit. That was objectionable in several ways, and as the result of combined effort we have improved the structure of the cable so that it is only necessary to make these unbalance tests about half as frequently as they had to be made when the quadded cable first began to be used.

The repeater is based on an invention of Doctor Lee De Forest, the electronic vacuum tube. The general staff
2335 of the American Company obtained patent rights from Doctor De Forest to his invention, but we did not have then a satisfactory repeater and a very large amount of work had to be done in improving the repeater.

The repeater is a kind of electrical valve and at a repeater station the telephone current coming in over a line is very weak. As the telephone current passes along the line it becomes attenuated so that at the receiving end it may have only about one per cent or so of the energy that was imposed on the line at the sending end. Now by conducting that receiving current suitably through the repeater which is also connected with a fresh source of electrical energy, the incoming current imposes its vibrations on the outgoing current which is sent along the line from the repeater in just the same wave form that the incoming weakened current possessed. That is somewhat similar to the way that the receiving radio set works.

2336 Repeaters are extensively used in the Bell System. The development of the repeaters was going on pretty largely in the decade from 1905 to 1915.

2338 The Bell Telephone Laboratories, Inc., is an organization of about 4,500 people, approximately one-half of whom are trained scientists and technicians. The Bell Laboratories, Incorporated is a non-profit organization which is owned equally by the American Telephone & Telegraph Company and the Western Electric Company, and it does work for each of its owners at cost. It operates a large building exclusively devoted to laboratory work, and there are about 11 acres of floor space in this building used for labora-
2339 tories. About one-half of the 4,500 people are trained engineers or scientists.

The relation of that organization to the Department of Development and Research of the American Company is this: It is the duty of the Department of Development and Research to maintain close contact with the operations of engineers and either through them or directly in the field, to study the needs of the Bell System to find what needs to be developed. When it appears that there is necessity for developing a piece of apparatus the Department of Development and Research studies very carefully what are the conditions which that piece of apparatus should fulfill; then the development or design of that piece of apparatus is put up to the Laboratories with the conditions to be met. During the development work there are always problems involving a choice between one path and another and there is very close co-operation between the Department of Development and Research and the Laboratories in order that these problems which arise during the development can be discussed and debated. When the
2340 laboratories finish their task of producing the piece of apparatus to meet the requirements, the Department of Development and Research reviews their work and when necessary determines by test and observation under field conditions whether or not the apparatus which has been produced fully meets the conditions which were laid down. If it does

not it is sent back for further development work. If and when it does, the piece of apparatus is recommended to the Associated Companies as a Bell System standard.

There are 2,500 people in the general staff and 4,500 in the Bell Laboratories. A little upwards of 3,000 out of these 7,000 people are trained scientists, college graduates, or engineers. The remainder of the 7,000 are clerical employes, draftsmen, model makers and people of that kind.

2341 With reference to the work done by the general staff in relation to its study of pole preservation—I think that perhaps the most interesting portion of that work is this: That for about 25 or 30 years we have maintained a group of specialists devoting their time and attention to the preservation of timber. In the early days of our work we placed experimental poles treated with various preservative methods in parts of the country where rotting of timber ordinarily progressed rapidly. They were placed in lines alternately with untreated poles and the life extension from the treatment has been observed from actual experience.

It rather early developed in our work that creosote, or what is more accurately known as dead oil of coal tar, is the most efficient of the preservatives available. Some of the early poles treated with dead oil of coal tar after ten and fifteen years' exposure to the elements have been removed from the line and the oil extracted from the timber. Now, we knew at the time these poles were treated what the composition of the oil was. Creosote is a very complex material. We extracted the oil from the wood after the poles had been exposed ten or fifteen years to determine what constituents of the oil had passed off and which had remained and proved most ef-

2342 fective, and compared that with the original oil placed in the timber; and the results of that have been very valuable in enabling us to specify the most effective types of oil for timber preservation.

We have at the present time a test station on the shore of the Gulf of Mexico, where conditions are very favorable for the rapid decay of timber, and we have experimentally treated

poles placed there under observation. They cover not only the types of preservative we are using now, but they cover various toxic mineral salts and other types of preservatives that have been proposed in recent years. The aim is that we shall know the relative value of different preservatives and different preservative treatments, and from time to time advise the Associated Companies as to the results of our work in studying the effectiveness of these treatments. If it were not done in this way once for all for all of the companies—it is a problem in which all the companies are vitally interested, because of the gradual depletion of our forests and the necessity for the conservation of time is increasing—probably all of the companies would have to do some work of this nature in order to keep themselves advised as to the most effective kinds of timber treatment.

2343 I have not attempted to enumerate all the work the general staff has done in the outside plant development. I have been asked about certain typical cases. There are literally hundreds of problems on hand at the present time and that condition of a very large amount of work pending is a chronic condition in our development work.

I don't know that I can say the general staff developed the first form of dial operated equipment. Very early in the switchboard art there was a form of dial equipment which resulted from a basic invention of a man named Strowger and the first work that I remember in the staff of dial operated equipment started fully 25 years ago, maybe more.

The history of switchboard development up to that time had been with the so-called manually operated board. It was changed and improved from time to time, with more and more of the operations becoming automatic. Thus, at one time, the drop signal to attract the operator's attention had to be restored by hand, after it had operated, and there were inventions made whereby it was automatically restored when
2344 the operator inserted a plug in the answering jack of the calling line.

After a time it seemed apparent that the last of the manual operations in the switchboard could be made automatic in all except certain classes of calls. Twenty-five years ago or so opinions of engineers differed as to the best type of switchboard. Some engineers and manufacturers favored completely manually operated equipment; others favored what was known as semi-automatically operated equipment, where a call was received by the operator and the operator completed the connection by so-called automatic equipment. There were others who favored the so-called full automatic operation. At that time central office specialists of the general staff did not advocate any one of these, but considered them in an unprejudiced manner in order to determine which was the best. The American Company secured patent rights covering all forms of automatic equipment in order that the development work might proceed unhampered.

A great deal of development work was carried on and finally reached a stage where it seemed as though quite extensive field trials under operating conditions of the apparatus was warranted. Switchboard installations of several thousand lines each were operated in Newark, New Jersey, and for
2345 five years were under continuous observation by staff engineers in order to settle certain points in the design, which could only be settled by these large installations under operating conditions. There was also the very important problem that the so-called automatic or dial apparatus had not only to be made so that it would operate satisfactorily within itself, but it had to operate satisfactorily in connection with manually operated equipment which would be found in other parts of the city where the dial apparatus began to be installed. Apparatus to meet these conditions was worked out.

The final result has been that there are two kinds of dial operated equipment used in the system, the panel type, which has been devised by the staff engineers of the American Company working in co-operation with the engineers of the Bell Laboratories and the Western Electric Company. I think that

is the type used in Chicago. The other type known as the step-by-step was originally made and perfected by engineers of the Automatic Electric Company in Chicago, and it has been adapted through conferences with Bell System engineers so
that it can work in harmony with Bell System appara-
2346 tus. It is used in many of the smaller size places for
which it is adapted.

We use the term "sub-station apparatus" rather specially, meaning the apparatus which is at the subscribers' station, with the exception of the transmitters and receivers, which we do not consider sub-station apparatus. We classify transmitters and receivers separately but that is a mere detail in our business. Sub-station apparatus includes the desk stands and cords used with them, the condensers and ringers. A great deal of work has been done in improving the cords of subscribers' stations, making them more durable and making them more waterproof. We have done the same work with the switchboard cords.

It was found that a good many troubles occurred at subscribers' stations where a desk stand cord would become wet, either by leaving a window open at the time of a rain storm or by leaving a wet umbrella leaning up against it, or sometimes from floor washing operations. That would cause a
permanent signal at the switchboard and a trouble man
2347 would have to be sent to the subscribers' premises to
clear the trouble up. Also, it would tend to shorten the life of the cords by electrolytic corrosive action. These troubles have been overcome by making a cord that was able to stand submersion several hours. Finishes on desk stands have been made so that they will wear a great deal longer before showing deterioration and having to be sent to be refinished. A great deal of work has been done on what we call wiring plans, which are the arrangements in offices where several telephones are used. If it is desired, for instance, to have a master telephone which will cut off all the other telephone when it is being used, and arrangements to call one station from another, from an incoming station. There are a

great many of these wiring plans and the best methods of connecting them up and installing them have been described in handbooks which have been furnished to the Associated Companies and extra copies of which they obtain at the mere cost of printing and paper, as they wish them.

A "protector" in connection with the installation in a house is an appliance which is used on these very delicate and
2348 sensitive telephone lines to prevent the destruction of the apparatus and injury to the subscriber or the risk of setting his premises on fire from lightning or from high tension currents, electric lighting and power currents if lines of that description become crossed with the telephone wires.

I might say in that connection, as compared with electric lighting and power apparatus, the telephone apparatus is in a special class by itself, as regards its delicacy and its sensitivity to weak currents.

The staff in the early days of the business devised a system of protection consisting of a lightning arrester, a fuse and heat coil, which enabled the lightning arresters that had been used in the early days to be retained for purposes of lightning protection and yet not constitute a hazard from their operation when a lightning discharge was followed by a strong current from an electric light or power wire on the line. But it was found that the type of lightning arrester which was necessary to secure adequate protection was likely to be affected during a lightning storm, so that sometimes many hundreds of subscribers' lines were put out of service as a result of the operation of these lightning protectors.

Now, it was a very desirable thing from the stand-
2349 point of the operating companies in the field to have a protector which was sufficiently sensitive to protect the apparatus and yet would not get into trouble at the time of lightning storms.

Development work was carried on, which resulted in a new form of protector, which reduced the unnecessary operation to less than one-fifth of what it had been before.

Now, that was very important from the standpoint of the operating companies, because it prevented service interruptions, which were annoying to subscribers, and it cut down the cost of maintenance because it reduced trouble upon the subscribers' stations after lightning storms.

Work has been done by the general staff in connection with the improvement of multiple jacks, prepayment coin boxes and pressed punch frame relays. Ideas that originate with employees of Associated Companies can be sent to the staff to receive a very careful study and consideration. If
2350 they hold the germ of a worthy idea the staff will see that they are followed up and developed and improved and the Associated Companies are relieved of doing that work themselves. In my opinion, it would have a bad effect on the service if there was indiscriminate inventing and development going on in the plants of the Associated Companies. It is better to have that concentrated than to have it carried on in connection with the regular operation of the plant.

There is a rather broad separation of functions between the engineers of the general staff and the engineers of the Associated Companies. The engineers on the general staff are developing, devising, testing and standardizing. The engineers of the Associated Companies in the field are constructing, operating and maintaining their plant. The difference is something like that which exists between the staff and the field in the army, where the officers in the field are concerned with where to place their troops and questions of when to fire and what to fire at. They do not at that time have to worry about the equipment of the troops or the designs of guns or ammunition, except that they are satisfied that through
2351 standardization the ammunition will fit the gun.

By "standardization" I mean the work which the staff does culminates in the recommendation of standard apparatus and practices to the Associated Companies in the field. The standardization is useful and beneficial because it insures that each company will use the best thing. It also insures that the apparatus will be made in the largest pos-

sible quantities, and uniformity in output contributes to economy in production. It also diminishes the cost of plant accounting, because there are fewer sizes and types of apparatus to keep track of. It also diminishes the cost of training employes because there are fewer things to get acquainted with. It renders available large supplies of material and men in the event of an emergency, like a sleet storm or a fire, because materials which have been made perhaps for the use of some other company of the Bell System can be shipped in large quantities to the territory of the company affected. When I say it renders men available I mean that men can be borrowed from other companies, and when they come into this particular territory they will find the apparatus is the same as that with which they have been acquainted at home and they do not have to become acquainted with special apparatus and
2352 practices.

Now, standards in the Bell System are dynamic and not static. We do not try to have one standard and force the business arbitrarily into that form, but we have as many standards as conditions require, and the work of the engineers in the field of the operating companies is very largely a choice of standards suitable to the conditions they have to meet.

I have read the testimony of Mr. Wray in this case about some construction in Gary, Indiana. I think I can perhaps check the date of that conference a little more closely than Mr. Wray's testimony indicated. As I recall it, he
2353 thought it was some time in 1901, '02 or '03. Now, it could not have been prior to September 1907, because it refers to conferences that were held in my office in New York and I had no office in New York before September 1907. Also certain correspondence in our files fixes the date pretty closely as either the latter part of 1907 or the early part of 1908.

As I remember, Mr. Wray's testimony culminated in a statement that Mr. Hibbard favored one scheme of plant distribution and that I favored another scheme. Then he was asked which one was used and he said "The latter." He also testi-

fied, which I checked with him, that we had a series of conferences lasting two or three weeks. Now, if there had been any question of enforcing staff ideas the conferences need not have lasted two or three weeks.

It is clear in my mind there was nothing abnormal about this conference. It was rather a typical example of the way the general staff functions. Mr. Wray brought to our
2354 attention that he had a situation in Gary where there were two types of construction under consideration, and he asked the staff for its recommendations. He did that in a letter and I have the original of that letter. (This letter marked for identification as Plaintiff's Exhibit 59.)

Now, that letter indicated to me that Mr. Wray personally was in favor of what was referred to in that testimony as the "all-cable" plan of distribution and it is my recollection that the real fundamental difference of opinion at that time was between Mr. Wray and his general manager, Mr. Hibbard. The two or three weeks was spent in taking certain typical distribution problems involved in Gary, computing the costs under the two methods of distribution, consid-
2355 ering the relative safety and freedom from sleet storm interruptions, points of that kind, and the matter was debated at great length and finally Mr. Hibbard went back to Chicago and he wrote to us that it was his understanding that it was mutually agreed that the type of construction which the general staff advocated would be used at Gary. I have that letter with me. (Plaintiff's Exhibits 60, 61 and 62 marked for identification.)

The signatures on the letters look to me like Mr. Hibbard's signature. I confidently believe that it is Mr. Hibbard's signature. (Mr. Wray states the signatures are Mr. Hibbard's.)

2356 The letter of March 30th, 1908 from Mr. Hibbard to Mr. Carty is the letter I refer to as having concluded the question. I wanted to say just one thing further, and that was this: As I have already said, I believe at that time Mr. Wray personally favored what was known as the all-cable

type of distribution. Furthermore, that the advice the staff gave in favor of that was good because no competent engineer, in my opinion, from that time to this, would have considered the alternative type of distribution under those conditions. The so-called "all-cable" method has been used very generally not only throughout the Bell System but by independent companies in many parts of the United States. I have a copy of the letter here, which is Mr. Carty's reply to Mr. Wray's first letter, which I wrote myself and signed for
2357 Mr. Carty.

(Letter marked Plaintiff's Exhibit 63 for identification.

In answering the question as to in what way the general staff makes known the results of its work to the Associated Companies in addition to the conferences concerning current matters such as disclosed by the correspondence with Mr. Wray and my testimony thereon, I may have to refer to some figures that I have noted down because I do not carry them customarily in mind.

The results of the work of the staff are made known to the field in several ways: By means of one class of publi-
2358 cations known as "Bulletins," by others known as plant engineering circulars; others known as traffic circulars; others known as commercial letters and frequently by special or direct letters.

In the past, before the plant engineering circulars commenced, we issued a great many general engineering circulars, as they were called. Up to the end of May in this year, the staff had issued 418 bulletins, 2,120 general engineering circulars, 352 plant circulars and I might mention that those have gone out in the space of about one year; Also 423 plant engineering letters, 273 traffic circulars, 432 commercial letters, 117 commercial circulars and over 4,000 specifications. This covers a period in general, since we began to issue information to the field.

(Mr. Bangs states that at request of the City he has tendered for examination all of the engineering, traffic and com-

mercial circulars sent to the Company during a year and a half which were filed with the Illinois Commerce Commission.

2359 Mr. Haight states the material consisted of ten volumes, one of which referred to general accounting matters from which no extracts have been taken. The other nine volumes average 300 pages each. Certain letters and documents have been selected therefrom.)

2361 I made an affidavit on or about October 5, 1923, which was filed in the motion for the temporary injunction in this case. I have not attempted in my present testimony to enumerate all of the services rendered by the general

2362 staff and I did not attempt to enumerate all of the services in making that affidavit. I took what I considered to be typical examples. In my testimony today I have not mentioned some of the matters covered in my affidavit, for example, I have not mentioned the development of hard drawn copper wire, wireless telephony or fundamental plans. That is a very important branch of the work. I mentioned a little about the dial with reference to switchboard development. I did not mention building plans, transposition, electrical disturbances, interferences, transposition im-

2363 provements, co-operation with national bodies, such as National Electric Safety code, American Institute of Electrical Engineers and National Electrical Light Association.

Electrolysis is applied to the destruction of underground metallic bodies by the action of the grounded return current from electrical traction systems. Unless means for mitigating this trouble are designed and installed, there is apt to be in various place in large cities an erosion of the metallic sheaths of underground cables. When that is sufficiently protracted it results in a hole in the sheath, water en-

2364 ters the cable and the service is destroyed until a replacing length is introduced or the cable is dried, so it becomes very important to prevent electrolytic corrosion from occurring.

Our staff keeps the Associated Companies advised by means of bulletins and circulars of the best methods for making electrolytic surveys to determine where these dangerous conditions occur, of designing proper electrical drainage wires to prevent electrolytic corrosion, and as to the entire technique of making electrolytic surveys, of platting electrolysis maps, designing the feeders and periodically keeping track of electrolytic conditions.

If subways were constructed in Chicago and grounded traction wires were installed, that would increase the trouble. The Illinois Bell would have the benefit of all that has been done by the general staff on that subject.

2381 *Cross-Examination by Mr. Haight.*

In respect to my testimony as a whole, I am speaking generally of my own knowledge, but I have been describing the work of other people which I know as a part of my connection with the telephone business. I have testified a great many times on this subject. The activities of the general staff have increased since 1923. The advice given by the general staff to the local companies covers all fields in which the Associated Companies are interested.

2382 Plaintiff's Exhibit 56 entitled "Tabular View of License Contract Services" is given as of the year 1928. I have a table that was prepared January, 1924.

(Table marked for identification as Plaintiff's Exhibit 56-A.)

Perhaps the most striking point of difference between Plaintiff's Exhibit 56 and Plaintiff's Exhibit 56-A is that Plaintiff's Exhibit 56 as of 1928 shows the Bell Laboratories and its relation to the Department of Development & Research.

2383 The Bell Laboratories was organized about the first of January, 1925. The Bell Laboratories owns patents only transiently. That is, the patents are taken out by its patent department and then they are passed on either to the American Company or the Western Electric Company.

I referred this morning to some 9,000 patents of the A. T. & T. as owned or controlled or licensed. I mean by that some of the patents are directly owned by the American Company, others are controlled through the American Company's ownership of the Western Electric Company and in others either
the American Company or the Western Electric Com-
2384 pany holds a license. As of March 31, 1929, there were
2,444 patents owned by the A. T. & T. Company and 3,639 by the Western Electric Company. I don't know what the situation was in any of the years 1923, 1924 or 1925, but the number can be obtained. I couldn't say offhand whether
the proportion was about the same.

2385 In the affidavit as of January 1, 1923, there were more
than 4,600 United States patents which the American Company either owned or controlled or was licensed under. I can't tell you exactly how many of those were Western Electric owned, but I can go back to 1922. Out of the 2,500 patents at that time there were about 700 owned by the A. T. & T. Company, and between 1,800 and 1,900 by the Western Electric Company. Some of the patents of late years relate to radio.

Prior to the organization of the Bell Laboratories the development and research work was done in what was called the Bell System Laboratories which were operated by the Western Electric Company. During that time prior to 1925,
for several years prior thereto, this same general pro-
2386 gram of giving information and advice was followed
by the A. T. & T. Company in its relations with the local companies of the Bell System. It was less extensive in 1923 than at the present time, and the best measure that I have of that is the size of the staff that was required to perform that work. In 1923 there were about 1,800 people in the staff, as against 2,500 at the present time. The same policy was followed during those years in regard to establishing standards, etc.

I don't know of many instances where a local company

refused to abide by a standard fixed by the A. T. & T.
2387 Company. I know of some. I know of a good many
cases in regard to construction tools. I can't recall a particular company, but it is in my mind that it has occasionally happened. You wouldn't expect it to happen very often, because this is a case where the different associated companies consulted the same source for advice, and where the conditions under which they applied for advice were the same, you would expect that the advice given would be the same.

We hope they will follow our advice. If our advice was not good and they didn't follow it, it would indicate that we were not doing our work properly. I couldn't assign any
per cent to the cases where they do not follow our ad-
2388 vice, but I know that there are cases. There have been
quite a number of cases but I don't bear them in mind and I can't say specifically in which company it occurred. I do not, right at this moment remember any such instance.

The general staff devotes no time to the management and operation of the long lines. I should say that a considerable proportion of the staff devote part of their time in performing services for the long lines. For instance, there are portions of the staff having to do with exchange equipment and exchange switchboards, and there is a portion of my own organization that has to do with the development of fine wire cables, none of which has any application to the long lines.
The portion that has to do with transmission develop-
2389 ment, with repeaters and work of that kind does find
an application in the toll plant of the Associated Companies and also in the plant of the long lines, and the general picture is that not much more of the activity of the staff than is represented by the relation of the assets of the long lines to the assets of the Associated Companies is a measure of the portion of the time that we devote to that. The long distance business of the A. T. & T. Company is in the long lines department. I think there are one or two of the men in the legal department of the general staff on the long lines

staff and they are the only ones from the general staff. There is nobody in the department of operation and engineering, and nobody in the department of development and research that has anything to do with the specific operation of the long lines department.

I think the officers of the Western Electric Company determine what apparatus is to be manufactured when the
2390 Western Electric Company manufactures apparatus. In regard to the new apparatus, the Western Electric Company does not determine whether certain types of apparatus are to be manufactured at all. That is determined by the general staff and its determination is based on the needs of the business and not from the point of view of what the manufacturer desires to sell. That is what I have said before a good many times.

When the Western Electric Company manufactures an article it is as a rule under patent protection. I think the Western Electric Company owns these patents covering
2391 the articles and the equipment which it manufactures and sells. If you, for instance, should buy an article from the Western Electric you would probably not need any agreement from the A. T. & T. to permit you to use it, but you would probably pay something in the price for the use of it. That is not true of the local company when it buys it also, because the local company is charged nothing for the patent. There is a different price to the general public than the price to the Associated Companies. I don't know that the difference in price determines the value of the patent. I think the patent is a factor in the difference. I don't know but what there may be other factors. I don't know about the prices of the Western Electric Company generally.

2392 The general staff gets its information as to the needs of the local companies from consultations, conferences, and visits to the companies, and from following up the operation of the apparatus in the field. That is, they tell us their symptoms. When they tell us of their difficulties, the function

of the general staff is to solve them. I should put it this way; to give them the advice that will enable them to solve the problems themselves. None of the Associated Companies undertake any technical development or research work.

I couldn't say off-hand how many of the 4,600 United States patents which the American Company owned or controlled in 1923 were taken out by members of the general staff.
2393 The number taken out by members of the operating staff in the Bell System in the field has run very small. I have a recollection of a figure of about 2 per cent being found at one time. I think I can give you a little something on that. Of the owned or controlled patents in the Bell System around 1922, about 11 per cent were taken out by employees of the A. T. & T. Company; about 74 per cent by employees of the Western Electric Company; about 2 per cent by employees of the Associated Companies and about 13 per cent by people outside of the Bell system. At that time the result of the operations of the general staff in patents was about 11 per cent of those owned or controlled by the A. T. & T. Company. Now you appreciate the reason for that is because the problem of devising the specific apparatus
2394 to meet certain conditions was put up at that time to the personnel of the Bell Laboratories, which was the Engineering Department of the Bell System. Devising specific apparatus to meet those conditions was where the invention lay, so that naturally from the system of operations most of the patents came into the Western Electric Company in that way. In making the allocation giving the 11 per cent to the A. T. & T., I think the truth of the matter was that I neglected to include employees of the long lines with the A. T. & T. because I don't think there have been any appreciable number that have come from that source.

A partial explanation of what has happened is that it has been the policy of the A. T. & T. Company to take to its general staff men who show ability in the scientific and technical lines as inventors or otherwise, and to take them
2395 from the staff of the Associated Companies. There has been constantly an interchange of men between the field

and the staff. The staff has furnished men like Mr. Hale and Mr. Mapes to the Illinois Company, and it has from other companies taken men who have had long experience in the field. That has always been done by arrangements with the Associated Companies, to make sure that the proposition that was made to a man to come to the staff was agreeable to his superior officers in the Associated Companies. We don't go out and snatch men away from the Associated Companies.

I don't know whether the plaintiff in this case ever made any independent investigations of the validity or scope of any of the patents of the A. T. & T. Company or the Western Electric Company. I can't separate out for the Illinois Bell Company the number of patents owned or controlled or under which the A. T. & T. Company is licensed actually covering
equipment used by the Illinois Bell Telephone Company
2396 in its Chicago plant. I did make an examination at one
time, a few years ago, and to my recollection at that time there were about 1,000 patents in use in the field, in the entire operating field in one way or another. I can't say how many of those 1,000 patents have or have not ever been tested in court The 1,000 referred to were live patents as of the date I made my investigation.

Some of the patents, the title to which is in the A. T. & T. Company, were transferred to it by the Western Electric Company on the basis of the cost of soliciting those patents. For a great many years the transfer at the cost of soliciting
was the only basis. I don't know when it wasn't the
2397 only basis. I am not in the patent department and cannot tell you that. I don't know how much the A. T. & T. Company charges the Western Electric Company for licenses under patents of the A. T. & T. Company.

I know there was a patent suit that came up in New York against the New York Telephone Company which affected the Illinois Bell and would have affected every operating company in the United States. It related to switch board circuits, and the American Company undertook and carried on the defense of the New York Company. It was just as vital a

suit for the Illinois Company as for the New York Com-
2398 pany. It was not also vital to the A. T. & T. Company from an operating sense, because it was used little if any in the plant of the long lines. I don't remember the date of that suit. It was known as the Herzog case. It was in the early 1900's.

I shouldn't say that was the only instance of giving any patent service. It is the only case of defense against a patent suit that I recall. Of course, you appreciate the reason that doesn't happen is because our Patent Department is very vigilant and active in order to keep from recommending anything that does involve infringement of rights outstanding.

2399 Corresponding transmitters and receivers could not be bought in the open market from somebody who didn't have the Western Electric or A. T. & T. Company patents. Transmitters or receivers can be bought on the open market. I think there are many patents on the switchboard that I can't recite right now from memory, involving both the circuits and apparatus, patents covering the quadded cables, patents covering the loading coils and patents covering the protectors—this material covered by these patents could not be bought on the open market from somebody who didn't have the Western Electric or the A. T. & T. Company patent.

2400 It was 1914 or 1915 that we first talked from New York to San Francisco.

2401 Theoretically, if a very huge wire had been used you could talk over the telephone from New York to San Francisco without the Pupin coil and without the repeaters, but it would have been commercially entirely impractical.

The first New York-San Francisco circuit was equipped
2402 with loading coils and repeaters, but the loading coils have subsequently been removed and we talk with repeaters now. I will agree with you that a repeater is essential to a talk of that distance. The repeater is built up from Mr. DeForest's invention as a result of a great deal of additional work.

The Pupin coil with its improvements from time to time are all built upon the invention of Dr. Pupin. I have not the figure exactly that the A. T. & T. paid Dr. Pupin for the patents on the loading coils but I think I can tell approximately. I think he was paid a lump sum of about $200,000 and perhaps $15,000 or $20,000 a year during the life of the patent. I do not know and never did know what was paid for Mr. DeForest's invention or for rights under Mr. DeForest's invention upon which the repeater has been
2403 built. The Pupin coils are used in local exchanges on long inter-office trunks. I should say that in general they were not used in trunk lines of less than five or six lines in length.

In the work of the Development and Research Department of the A. T. & T. the scientific problems of the greatest difficulty have not been those relating to the long lines service. A portion of the problems of the greatest scientific difficulty have related to the long lines service and the toll service of the Associated Companies. Some of the scientific problems that have taken the most time and have been the most difficult are those that relate to toll service generally, but I would not make a broad classification of that kind.

2404 The early research work respecting the telephone was done at the laboratories of the American Bell Telephone Company. Hammond V. Hayes was the man in charge. He was my superior when I entered the employment of the American Bell Telephone Company. I had a connection with the work at that laboratory from 1892 until 1907.

At that laboratory a great deal of work was done upon transmitters and receivers and induction coils. There was a period of time during which they tested those that were shipped to the various telephone companies who used them. During all of that time work was done upon instruments leased to telephone companies by the A. T. & T. or its predecessor, which instruments the companies got under the license contract.

2405 The principal work done in the laboratory during those years did not relate principally to transmitters, receivers and induction coils. There was also work done there in connection with long distance and toll service. There was no patent covering hard drawn copper wire, but until it had been produced by Mr. Doolittle it had not been available in the art. There was no such material available.

Except for the Long Lines Division, Plaintiff's Exhibit 53 describes the entire organization of the A. T. & T.

2406 The Long Lines Division does not come in except—I never thought of it just this way, but I presume it reports to the president. It is my recollection that there is a long lines board composed of the vice-presidents of the American Company, over which Mr. Cooper presides. If the relations of the officers of the Company to the long lines department were charted, I don't think, so far as their expenditure of time goes, that they would have to do with the Long Lines Department to a very great extent. Mr. Cooper is a member of a group of men who pass on long lines affairs, but the Long Lines Division heads up in a general manager, Mr. T. G. Miller, who is equivalent to the president of an associated company.

2407 Plaintiff's Exhibit 53 is dated June 6, 1929. I should say that the organization was generally the same on June 30, 1923. The main functions have not changed as I recall it.

My testimony was directed only to what might be called the plant services, and I think that the Pupin coil, etc., mentioned in my direct examination, were good examples of the more important services performed in regard to the plant of the Associated Companies. I do not have in mind any services that I should say were strikingly more important.

2408 Plaintiff's Exhibit 56A was prepared jointly under the direction of Mr. Crunden and myself. It was not examined or approved by any other officers of the A. T. & T. I should say from my recollection that I prepared the chart for Exhibit 53. I might say that in the preparation of these

charts I consulted a representative of each of the departments mentioned, in order to see if I had given in his judgment a fair picture of the work of his department. I took advantage of some of his suggestions of things that I had omitted.

In my direct testimony I gave estimates upon the savings made to local companies upon certain contributions made by the A. T. & T. I consider my estimate, in each case where I made one, a fair estimate. I only recall one that I made,
which was 17 million dollars, which had been saved from
2409 the sheath alloy. That certainly was a fair estimate. I
do not consider the savings made a fair measure of the value of the service. I think the service is worth very much more than is reflected by one sum of that kind saved in one particular thing. If you gave me some advice today by which I could save 10 million dollars, I would not consider 10 million dollars or more a fair fee.

2410 I regard the 4½ per cent payment as made for a continuous service. These benefits are coming out more or less continuously. Now there is no continuing charge for something that has been done in the past, and I regard these examples which I have mentioned as merely the proof of the capabilities of this organization to furnish services of value, and it seems to me that the best way that capability can be shown is by what it has done in the past.

If the A. T. & T. in 1900 paid Dr. Pupin $200,000 for his inventions relating to loading coils, and then paid $15,000 or thereabouts annually during the life of the patent, I should not figure that the service rendered in the purchase of that patent was one on which I would make a charge in figuring the value of the service over the entire period of time. What has actually happened has been this. Over the period of nearly thirty years since Dr. Pupin's invention we have had a group of people continually studying to improve loading coils. That has been a direct and continuing service to the
associated companies, and I should not regard the pay-
2411 ment made in any particular year as having any relation to the sum paid for Dr. Pupin's patents.

Dr. Pupin's invention was of value at the beginning, but there have been something like sixty or seventy patents that have come out since relating to loading coils. Dr. Pupin's patent was not on the structure, it was on the principle. He did show in one of his patents one type of loading coil, but it was not the type of loading coil which proved to be useful in the operation. His patent was primarily a mathematical physical principle. It was patented because he showed a means of accomplishment.

2412 If I were figuring the value of the services performed by loading, I should arrive at it in this way. It is possible to determine the size of the large conductors that would be required if they were not loaded. If there were no loading, large wires would be required, and you can figure what it would cost in the plant today to give the same degree of transmission efficiency with large wires without loading coils. Now against that you can figure what the cost of the plant is with small wires with the loading coils. That is the way I figure in determining the value. I did not take into account the fact that Dr. Pupin's patent expired back in 1917.

When I make my comparison I compare the thing now with something that existed before Dr. Pupin made his in-

2413 vention. Of course, his invention was only one of many factors which have entered into the production of the commercial loading as it is carried out today. I don't know anything about telephone rates. I don't know whether in determining the telephone rate by figuring the difference between the value of the telephone and what it might cost one to deliver messages by hand would be exactly the same philosophy that I employ in evaluating the service under the 4½ per cent contract.

2414 I don't know whether the A. T. & T. has rendered any legal services in this case on hearing here. I have nothing to do with the legal department. I don't know anything about the developments of E. N. Anderson in respect to a means through the use of relays of cutting in branch circuits from a multiple or bridge call circuit. I don't know that the

A. T. & T. used this for other Bell Companies after it had been developed by the Chicago Company.

I remember Mr. Bullard, now deceased, who was connected with the staff of the American Company, but I don't recall this particular invention of the pre-payment coin box,
2415 or that he made it. I don't know that after he made that invention he was then taken to the American Bell, but I know that he was with the American Company at one time. I don't know that he made such an invention, but I know that he made a number of inventions. I don't identify this particular one.

I know there was a patent of some importance relating to machine ringing which was taken out by Mr. Hibbard of the Chicago company and, as I remember, the Western Electric Company bought his patent. I have no idea upon what basis it was bought. I do not know where the ring-back signal which informs the calling subscriber that the called subscriber is being rung was developed or discovered. I have no knowledge that it was developed in Chicago and taken over by the A. T. & T. That is a central office matter that is outside of my particular office duties.

2416 I know there was a so-called Hibbard-Sabin express system. I know there were in the early days a great many rather unique and peculiar switchboard arrangements that were used in Chicago. I think it is only fair to say that Mr. J. J. O'Connell of the Chicago company was the first man to propose the use of lamp signals in switchboards, which was never patented. Phantom circuits are used very little in the local exchange in Chicago. I do not know whether they are used in Chicago at all and I should imagine not in the Chicago city exchanges.

2417 I should not be a bit surprised if the O'Connell phantom circuit was actually used in Chicago before the A. T. & T. produced a phantom coil. There were a great many phantom systems used both in the Bell field and in the independent field, but that was at a time when the apparatus was in a rather crude condition, and they produced results that

I think it is fair to say would not be tolerated in modern telephony. What really gave the impetus to phantom circuits was the improvement in it with regard to coil design, which followed the development of loading coils in the period from 1900 to 1904.

A great many of the bulletins sent out to the associated companies by the A. T. & T. deal with apparatus that is manufactured and supplied to them by the Western Electric Company. In regard to central office equipment, most of the apparatus they refer to is manufactured by the Western Electric Company. In the outside plant, with which I am concerned, I should say the greater part of the material is of non-Western Electric manufacture. I have in mind conduit material, man-hole frames and castings, poles, cross-arms, wire and guy strands. Those are the things that are
2418 of non-Western Electric manufacture.

Some private branch exchanges are manufactured by other manufacturers than the Western Electric I believe. As I said yesterday, there is some central office equipment that is manufactured by the Automatic Electric Company in Chicago. I don't think that the Illinois Bell Telephone Company uses that type of apparatus in Chicago.

2419 The services of the general staff are very much more than the services that any manufacturer would give to its customers. The service of an ordinary manufacturer is influenced by his desire to make the greatest manufacturing profit. That is not the case in the recommendations of the staff. The staff is an advisor for a client, and its client is the Associated Company.

None of the work that is done in any of the staff departments of the American Telephone and Telegraph Company is paid for other than by the American Company. The work that is done in the Bell Telephone laboratories is divided as to the cost between the American Company and the Western Electric Company. The Western Electric Company pays the laboratories for development work on such apparatus as is going to be manufactured by the Western Electric Company.

In the determination by the staff of the conditions to be met by that apparatus and in the final test preceding the
2420 recommendation, none of the expense of the staff engineers of the American Company is charged against the Western Electric Company. Going back to June 30, 1923, in respect to research and development work done upon apparatus to be manufactured by the Western Electric Company, it was the same arrangement and division of charges that I have just described.

In the early days we had three laboratories and experimental departments in the Bell System. There was one conducted in Boston by the American Bell Telephone Company and its successor, the American Telephone and Telegraph Company. There was one of the Western Electric Company in Chicago and one in New York. In 1907 all these laboratories were concentrated in a building at 463 West street in New York and they were regarded in the organization as the Bell laboratories—not known so by name, but the laboratories of the Bell System, part of the Engineering Department of the Western Electric Company. At that time, the American Company paid the Western Electric Company for work
2421 done on such items as the development of transmitters and receivers, and all of the work that was done on vacuum tube repeaters, and work that was done on fundamental research, and such work as did not result in apparatus to be manufactured by the Western Electric Company. It was substantially the same division that I have outlined obtaining at the present time.

It is not true of any article finally adopted as standard by the Bell general staff that the development cost that the Western Electric Company has gone to in the development of that article is charged as part of the cost. There is a large expenditure by the Western Electric Company that is charged directly to the American Company, and it is only a portion of that expense which is represented in the detailed design of the apparatus that gets into the cost. There is in the development of any piece of apparatus a considerable expense

which is borne by the staff department of the American Company. In some cases the results of these developments
2422 and researches are given to the public. Some of them are published in journals of scientific societies, in the American Institute of Electrical Engineers, etc.

I wrote a paper once on the preservation of timber which presents the results of some of our work in extending the life of timber. It seemed to us it was a desirable thing to have that known to the public in the interest of the conservation of timber; that knowing what could be done to conserve the supply of timber was of advantage to the entire Bell System as well as to the rest of the country.

The invention of twisted pair goes back to Alexander Graham Bell about 1879. Twisted pair cables came into use first in their originally crude form in the late eighties of the last century, about 1887.

2423 The time when the 22-gauge cable was adapted for use by the Bell System is shown on the exhibit which I had of the cross sections of the cables. It first came into use in its present form about 1901. I think it may be well to state that in the very earliest days of the cable art that there were cables that contained twenty-two and even as small as twenty-six gauge wires. There were some that were used in the large cities that were not cables of the present structural form or the present efficiency. They were then a very elementary and crude form of cable, and would have been totally insufficient for any of the telephone service today. Prior to that, twenty-two gauge cables were used by independent telephone companies. I think that ever since the independent companies have been using the twenty-two gauge fine wire cable
2424 extensively. There is nothing patentable about it. The single wrap paper insulation was adopted by the independent cable manufacturers very early. I don't know whether it was a number of years before it was adopted by the Bell System. That has no particular point. It does not make any difference in the final result whether a cable is single wrap or double wrap paper insulation. It is a question of the

quality of the paper and the result in service after the cable is finished.

When I talked yesterday about the wrapping of a paper spirally on a wire, I did not intend to imply that there was any patent upon it, but there is a lot of knowledge behind it as to how to put it on. I should not say that it is usable by anyone. We recommended the 99 per cent lead and 1 per cent antimony cable sheath first for use in underground in 1912 and for use aerially in 1913. I never knew
2425 the independent cable manufacturers had been supplying that to the independent telephone companies for many years before that. I don't know when they did begin. I think a good many independent manufacturers make that alloy now. They pay no tribute to the American Telephone and Telegraph except the tribute of copying that sheath.

As far as I know, the Bell System first used that sheath. Not only that, but we entered into the use of it only after we had satisfied ourselves by very thorough tests that it was going to be an improvement. As far as I know, in the independent field the general practice for a good many years was to use unalloyed lead sheath on cables. In aerial cables a great many companies got into very serious trouble by the cable sheath crystallizing and cracking.

2426 All of the various things I have described were first used under the recommendation of the staff in the Bell System. They were all used in the form recommended by the general staff to the Bell System for the first time
2427 in regard to the particular form in which first used. As to which of the various things I have been talking about I definitely know were first used under the directions of the general staff by the Bell System, I should say in the order of my testimony first of all loading coils. Then
2428 I was asked subsequently about telephone repeaters. They were in that class. The modern forms of fine wire cable were first used. I do not mean to include in that the fact merely that that means the use of small wires, because it does not. It means much more than that. Fundamental plans were first made and used in the Bell System.

Carrier current was first used in the Bell System. Successful operating Phantom circuits were first used in the Bell System.

2429 The original invention as to loading coils was Dr. Pupin's. The repeaters were built on an invention of Dr. DeForest. Dr. Pupin and Dr. DeForest made the first contribution. The germ that set the development going.

There are no patents on fine wire as such nor on fundamental plans as such. Fundamental plans are the means that have been worked out for making the best prediction of future telephone requirements.

2430 There was back of carrier current a whole prior art, with perhaps twenty different inventions contributing a little something each which made it possible to bring these things together and, by the invention of the band-pass filter, to make it possible to bring the carrier current to telephony. General Squier was not the man who originated that. There were a great many scientists back of him. I might mention in that connection that General Squier did not contribute anything that was useful in making our carrier current operate.

In some cases what we have done is to take the work of others, develop it, refine it, improve it, and make it more useful. We have made workable, useful things for the service of Associated Companies and have looked into the best way of using those things and the most economical way, and advised them how to do it.

2431 Some of the work on loading coils was done by the Western Electric Company, and a great deal of it was done by the general staff engineers. I know something about what kind of wire was in Chicago in 1900 or 1910, because I made an inspection of the system in Chicago in the early days and familiarized myself with the operating conditions. I should be surprised if loading coils had not been used in Chicago prior to 1910. I do not recall from memory. I remember the first New York-Chicago line because my first job in the telephone business was to make tests on that wire

at the factory of the manufacturers. I was not familiar at all with the Chicago plant at that time. I did that work in testing those wires in 1892 and I think it was in 1893 that the line was opened.

2432 The local exchange in Chicago might have had some grounded circuits at that time. The transition from grounded to metallic circuits took place largely in the decade from 1890 to 1900. The development in respect to wires has been away from aerial wires and towards aerial cable and underground cable.

I wouldn't say that most of the development work in regard to loading coils was done by the Western Electric. There was a great deal of important work done by the Western Electric Company; but I recall in the early days in the period following 1900, I spent a good deal of time in the laboratory making electrical measurements on new forms of load-

2433 ing coils. The work consisted of several parts. One was the actual mechanical perfection of the coil and the development and invention of machines for winding coils economically. Another very important side, was the economics in the use of the coils, to have the proper type of loading; to determine the spacing between the coils, and the amount of inductance in the coils to give the most economical results. All of that work was done by the general staff of the American Company.

It is not true that most of the development to produce this loading coil was done in the factory of the Western Electric Company and not in the laboratories. The work that was done in the factory had to do with methods of manufacture, winding machines for applying the winding to the core, that kind of work was done in the factory of the Western Electric Company; but the development of this pressed core was done in the Bell Labortories as was also the development of the permalloy material.

2434 I don't know how much the particular coil that you hold in your hand weighs. It is very light. It can be determined if it is a matter of importance. This coil was developed after June 30, 1923. Questions of winding

machinery, cost of manufacture and other questions of mechanical sorts were not all the questions in regard to the development. The fundamental point in that coil is the development of an improved magnetic material that the core is made of. The substance permalloy—the fundamental characteristic of that, enables the coil to be made smaller and cheaper. The culmination of the work on permalloy was in the patent which came out in 1925 and 1926. Permalloy coils were first used in January, 1927.

2435 Transposition is the interchanging of the position of the two wires of a pair at regular and predetermined intervals for the purpose of avoiding the overhearing between parallel circuits and keeping the telephone circuits quiet from the noise that would be induced in them from paralleling light and power circuits. I don't remember whether there are any patents on that or not.

There is a vast amount of work behind it in knowing where these transpositions should be placed. There is a force of engineers continually working those up. There are literally hundreds of thousands of different transposition schemes that have to be examined and computed in order to ascertain the most effective ones. Then in every new change in the electric light and power art, new schemes of transposition have had to be developed and it has been a continuous work in enabling telephone circuits to be kept quiet. I have in mind open wire and quadded cables.

2436 I don't remember when the general staff first recommended the automatic system to its subsidiaries but I think it was shortly before the great war in Europe in 1914. I do not know how it was recommended, nor of any letter sent out by any officer of the A. T. & T. Co. respecting it to the associated companies. I never knew of Mr. Gherardi's letter.

2437 I couldn't testify from memory as to when the automatic system came into use by the independent companies but there were early forms of the step by step type that were used many years ago. There were some forms
2438 used as early as 1900. The step by step type is one of the two types now used by the Bell system but not in

the form in which it existed at that time. There have been a great many improvements on it.

The general staff has recommended two types of automatic system to the associated companies. One is the so-called panel type and the other the step-by-step type. The panel type is used generally in the larger places and the step-by-step type in the smaller places. I don't remember when the step-by-step type was adopted by the Bell System. I couldn't say whether it was after the panel type. We objected to the use of the automatic for a good many years until
2439 it was in form to give the proper kind of service. I don't know much about the use of the automatic equipment in telephone systems in Europe nor do I know when it was and how it was that the Bell system first recommended against the automatic.

As I understand it the associated companies are not required to buy the automatic equipment from the Western Electric. They can buy anything they want from anywhere. I think the Western Electric is the only place where the panel type can be bought but they are not required to buy it. I am not familiar with the contracts between the Illinois Bell Telephone Company and the Western Electric but I know what the general purchase contracts have been between
2440 the associated companies and the Western Electric which made the telephone companies the most favored purchasers as regards price. I also know that the associated companies have never been compelled to buy exclusively from the Western Electric Company.

The Western Electric Company did not work upon permalloy. The Bell Laboratories did. G. W. Elmen worked on permalloy. I think there were others working with him as his associates but I don't recall their names.

Wireless is used in the telephoning from this country to Europe. Wireless does not have anything to do as yet with the telephone service here in Illinois, but I think it may have possibilities in the future. For instance there is a possibility in the connecting up of vessels in the lakes with cities.
2441 I should hesitate to predict that would never occur in the future. There are also possibilities on trains. I

think it is true at the present time that in the handling of the vast telephone traffic in the telephone system, which consists of about 33 million calls each day, the wireless telephone is wholly out of the question.

I think the Western Electric has sold some permalloy to European manufacturers of submarine cables.

When I testified that better transmitters and receivers had been developed, I had in mind the various forms of so-
2442 called solid back transmitter that are used in the Bell system—the 337 type, the 329 type and 323 type, all of those three types are used in the Chicago Telephone Company's plant.

What the general staff of the A. T. & T. Co. did in regard to the benefits claimed for the use of the automatic system, was to advise the companies as to what the possibilities of the system are, the best forms and how to install and maintain them. Then they use their own judgment as to where they will make use of that equipment. It is expected that it will ultimately create savings in doing telephone business. I can't tell you when the general staff thinks that saving will ultimately occur. I am not an expert on machine switching. I am on the general staff but I am on one particular portion of it. I am a specialist in outside plant matters.

2443 There are officials of the A. T. & T. Co. who are not on the general staff, but who are connected with the long lines. They are all subordinate to Mr. Cooper and are the ones that I have previously been asked about and have described at some length.

2444 It is a little out of my sphere of knowledge as to who does the work of the A. T. & T. Co. as a corporation, such as filing its corporate report, investing its funds, raising funds, etc. It has a board of directors and other officers like any other corporation. I think it is organized under the laws of New York.

2448 (Mr. Haight states that the circulars selected from the ten volumes furnished him by the Plaintiff for inspection were not taken at random).

2452 *Re-direct Examination by Mr. Bangs.*

I have examined the selected circulars which were marked for identification by Mr. Haight. There are some matters referred to in these circulars that I am personally familiar with. I am familiar with the letter dated February 18, 1921 referring to cable sheath.

Work done by the general staff in connection with the subject matter of that letter was this: previous to this time the thickness of the lead sheath on these cables varied between large cables and small cables by three steps. The larger cables had a sheath of 1/8 of an inch and the smaller ones 1/12 of an inch and an intermediate size for some cables that were neither of the smallest or the largest size.

2453 What we sought to do was to save some money for the associated companies by diminishing the thickness of the sheath as we stepped down from the large to the smaller cables by a greater number of steps, making the sheaths of some of the cables a few thousandths of an inch thinner than they had been before. Before we were able to recommend that however, we had to have cables made with those thinner sheaths and we had to test them carefully for their ability to withstand vibration and cracking and handling in the conditions of practice, and that we did, and have recommended a decrease in the thickness of the sheaths of some of the cables, the net result of which was to save all of the associated companies about $400,000.00 a year in their purchase of cables from the less amount of sheath material used. That is a matter in my department.

There was never to my knowledge at any time any direction or command or purported order given by my department or by any one connected with it, to the associated companies to use the sheath which would result in the saving I have spoken of.

2454 We give them the information that they can save money in this way and the general custom is for them to take advantage of the opportunity to make the saving. We don't deal with the associated companies with the idea of giving them orders. You can't produce good results in

that way. It is cooperative work. In my opinion the worst thing that could happen to the Bell System would be to reduce the officials of the associated companies to automatons who are forced to obey orders from a centralized source. We want their comments and we want the benefit of their experience in handling the problems in the field and then we want to do for them what can best be done by one centralized group. We get their comments very frequently. We go out to see them and get them.

2455 I am familiar with the matter covered in the letter dated January 3, 1921, with reference to the amendment to specifications No. 1798 manhole guard. The recommendation was made that the guard be painted with red instead of black paint.

I might explain in the beginning that these manhole guards are little circular fences that are set up over a manhole when it is open and the man working inside, in order to prevent traffic from going over the manhole. With the great growth of motor traffic in cities, these guards, which had formerly been painted black, did not serve to attract the attention of car drivers in the street and we changed the color to red, which would be more conspicuous as a danger signal. The word "requires" in the letter is a requirement on the manufacturer of the apparatus and not on the associated companies required to use it.

2456 The specifications referred to were the former specifications for the manhole guards and that is a manufacturing specification. The letter dated February 25, 1921, is not in my department.

I know something about guy rods. I can tell about
2457 the thimble guy rod and the reason for the recommendation made in the letter dated May 13, 1920. If I take a couple of minutes to do that, I think I can make it clear. The guy is the wire strand that is carried down from the top of the pole to an anchor in the ground to strengthen the pole against being broken off. Now this guy is made up of a strand of 7 wires. I think wire rope is probably the best term to describe it. An anchor is placed in the ground with the

rod coming up from it and an eye in the end. The guy is anchored by the wire rope being put through this eye in the guy rod. If it is just placed through the eye and bent back sharply, the strands of the wire rope will frequently be-
2458 come broken so a thimble is put in of larger radius of curvature than the eye of the rod, and the guy strands slipped inside of that. This is the former practice I am describing.

One of the engineers in my department made an improvement which was patented, which consisted in making the eye of the guy rod substantially of as large a radius of curvature as the thimble. That obviated the necessity of the use of thimbles which frequently would crush and flatten out and have their usefulness destroyed; also when the guys were installed the workmen had to hold the thimble and the guy strand in the thimble and when tension was put on the guy there was a tendency for him to get his fingers pinched in the strand; so by making this thimble guy rod with a greater radius of curvature, not only was the crushing of the thimble avoided but the safety of the workmen was increased because this operation whereby he was likely to get his fingers crushed, was obviated. That was all there was to that.

2459 What is meant by the word "specifications" as used in these various circulars is the accurate and detailed description of a piece of apparatus, which is designed for the manufacturer of that apparatus giving him the conditions which must be met by his product in order that it will be acceptable. It is the means whereby the material is ordered from a manufacturer and inspected in order to ascertain whether the requirements of the specifications are met. These specifications are not binding in any way upon the associated companies. They are customarily followed by them.

In all these various documents marked by Intervenor, that I saw, where pencil marks occurred, they were placed opposite substantially similar cases to those I have just been asked about in the matters with which I was familiar.

2460 (It is stipulated that the underscoring and pencil marks on the copies of the circulars are not on the original circulars.)

2462 It is not true that the general staff had never made any inventions at all but that all it had done was to improve on two inventions made by Mr. DeForest and Dr. Pupin. There have been a great many important inventions made by members of the general staff, and I should say in regard to both of those matters that the fundamental principles, while important in the course of development and improvement work that was carried on generally, becomes less and less significant and the amount of work required to make these appliances satisfactory, becomes of very great importance. I should say that the original Pupin patent and the De Forest patent were rather unique in the respect of being important patents not made by members of the general staff.

2463 Hard drawn copper wire is a very early development of Mr. Doolittle. He became associated with the staff of the American Company and he was a man with experience in wire manufacture. Copper wire at that time was the best conductor for telephone currents, but it did not have the tensil strength necessary to support itself in open wire spans. Iron and steel wire, which had the necessary strength but not the desirable electrical properties, was largely used for telephone wire. Mr. Doolittle went into the mills of the wire manufacturers and produced by improved methods of wire drawing, the copper wire which retained its electrical advantages and also was possessed of very nearly the strength of iron and steel wires and practically doubled the strength of soft drawn copper which was the only form in which copper wire could be had previous to that time. I think it was determined that it was not patentable. I don't know why.

2464 The fundamental plan briefly culminates in a study which shows the proper number of central office districts in which the telephone exchange should be divided for the greatest economy and facility of operation, sometimes for 15 or 20 years in the future. It shows the location of the central office, the probable number of lines to be served and the proper streets and alleys in which to place underground

conduit runs and the most economical number of ducts to place in the conduits when built. It is determined by what might be called a scientific guess of the future telephone exchange. That is based on a commercial survey, the first part of which is the telephone census of the community, the percentage of people living in individual residences, two family houses, flats and lodging houses, that take telephone service and the grade taken. When the probable future population of
2465 the city is determined as a whole and by districts, the best distribution that can be made of the probable future telephone subscribers and their service is laid out. Then all promising combinations of central offices and districts is laid out on a map and studied and the most economical arrangement over the whole period of time from the present to the future is figured out and the plans of the company proceed on that basis. Fundamental plans cover problems that every important company has, and when any important addition to the plan is made, the fundamental plans are revised in the light of the latest data.

To lay out the underground system most economically and to establish Central Office districts, those are all problems of the greatest importance to the management of an Associated Company, and the fundamental plan seeks to give them the benefit of the best prediction that can be made. Those methods have been developed through long experience by the staff engineers and they regularly keep the Associated Companies advised of the basic fundamental data on population, which they work out by keeping in touch with the Government
2466 authorities in Washington, working out information as to the results of immigration and emigration, migration trends of population and the trend from farm to city and the effect of the negro migration that has been going on. Then they are furnished also with data as to the trend in the size of the average families, because the family is the unit for telephone service.

The Illinois Bell has its own fundamental plan engineer. The work of the Illinois Bell engineering department on fundamental plans and of the general staff on fundamental

plans is very closely in touch. There is no duplication. The theory of our staff organization is that it prevents duplication.

It prevents duplication in this way. I have referred to
2467 some of these fundamental matters bearing on the population trends and tendencies. That is done by a centralized staff once and for all, and sent to all of the Associated Companies. Now, if that were not done in that way, the Illinois Bell fundamental plan engineers and the fundamental plan engineers in every associated company would each of them have to take steps to secure that information and there would be a vast duplication of work.

2468 As far as I can recall, I do not know any instance where the independent telephone companies developed and used, in satisfactory form, apparatus before it was developed and used by the Bell Company. I am testifying now both as to my knowledge of my own department and my general knowledge of the entire field.

I testified in 1919 before the Public Utilities Commission in the original Chicago Rate Case, and again in 1922 before the Illinois Commerce Commission.

2469 On Page 2386 of the transcript I testified that there were not very many instances where the local company refused to abide by the standard fixed by the American Telephone & Telegraph Company. By the word "standard" I had in mind the recommended standards of apparatus and methods of construction used in a plant. When I was asked the question about whether I remembered any instances in which the standards were not followed, I was using the word standard in the same sense.

I recall one instance where the general staff developed and recommended a form of cable terminal that the engineers of the New York Company did not prefer. They preferred a type which had been of previous standard and they continued the use of that. Now there may be others. We have no
2470 follow-up system of inspection to ascertain the extent to which standards are used. We don't go around inspecting plants of the companies for the purpose of ascertaining whether they follow our recommendations or not.

I think the policy of standardization is extremely beneficial and economical in the service to the public. Up to within a few years ago the most glaring example of no standardization was in France. In Paris there were 150 or so different types of telephone transmitters and receivers that were used. The subscribers bought and owned their own instruments, and as a result of that the service was greatly affected by the use of instruments that were sub-standard in their efficiency. It is only fair to say that in recent years the French Government has in their service worked away from that.

2471 If there had not been a policy of standardization in the Bell System, we would have had a sort of heterogeneous class of plant so that, in connections between one exchange and another exchange, the transmission would probably have been poorer than it is today. There would have been no opportunity or less opportunity for the correllation of operating methods to talk over considerable distances, and the economy of the plants would have been distinctly poorer within themselves than it is today. I think the cost of plant certainly would have been increased and presumably that would have been reflected in the cost of service.

The first long distance radio transmission of the human voice was across the Atlantic Ocean during the war, from Ar-

2472 lington, just outside of Washington, to the Eiffel tower in Paris. The general staff had all to do with the development of apparatus that made it possible. I won't say they had all to do with it, because the experiment was made possible through the cooperation of the United States Army authorities giving the temporary use of the wireless towers in Arlington and the great courtesy of the French Government in allowing the use of the Eiffel tower for short periods each night. That was the first long distance radio transmission of the human voice.

The vacuum tube was used in connection with that transmission. That tube was not covered by the DeForest patent, except that it makes use of the principle of three electrodes in the vacuum tube. But the tubes that were used then, compared with the DeForest tube, would not be recognized readily

as members of the same family. Huge water-cooled tubes were used for that purpose, with special apparatus for
2473 sealing the terminals in the glass. Perhaps I might say there that among the more important improvements which we have made in tubes for repeater service has been increasing the life of the tubes from something like 1,000 hours to 25,000 hours, and at the same time reducing very appreciably the amount of energy necessary to operate the tubes. Those are both factors that are important in their use by the telephone companies.

The repeaters are used in local toll service as well as long distance service and radio service. They are used in toll connections of the kind that would come within the limits of a single state, except a state as small as Rhode Island. I think every type of apparatus I described in my direct testimony has a bearing in one of the three classes of telephone service in Chicago, that is, local, toll, and long distance.

2474 *Re-Cross-Examination by Mr. Haight.*

The first fundamental plan was not to my knowledge originated and used by Arthur Vaughn Abbott, Chief Engineer of the Chicago Telephone Company in 1893 and 1894, and referred to Boston to Joseph P. Davis, Chief Engineer at that time of the American Bell. Mr. S. A. Rhodes, who has testified in this case, did not to my knowledge figure out, the first time it was done, how to locate the Central Office.

2475 FRANK REDMUND called as a witness on behalf of plaintiff in rebuttal, being first duly sworn, testified:

Direct Examination by Mr. Bangs.

My name is Frank Redmund. I reside at 5555 Sheridan Road, Chicago. I am Assistant Vice President of the Illinois Bell Telephone Company. I first entered the telephone business in the office of the General Superintendent of the American Telephone & Telegraph Company in 1893. I re-
2476 mained in that office until 1903, when I went to Indianapolis with the Central Union Telephone Company. I became Assistant General Manager of that company and re-

mained there until the headquarters of the Central Union Telephone Company were transferred to Chicago and soon afterwards was appointed plant superintendent for the Chicago Telephone Company in charge of the plant in Chicago. About a year later I was appointed General Plant Superintendent for the Chicago Telephone Company and remained in that position with the Chicago Telephone Company and its successor, the Illinois Bell Company, up to March, 1928, when I was appointed Assistant Vice President.

During this period I have been generally familiar with the services furnished by the American Telephone & Telegraph Company under the license contract, and during the period from 1911 to 1928 familiar in particular with the services rendered to the Chicago Telephone Company and the Illinois Bell Telephone Company.

2479 The following statement represents my best judgment on the matters set forth in the following statement—

2480 1.—FURNISHING OF INSTRUMENTS:

During the year 1923, the American Telephone and Telegraph Company furnished to the Illinois Bell Telephone Company, the receivers, transmitters and induction coils used in furnishing telephone service in Chicago at Subscribers' Stations and at Private Branch Exchanges and Central Office switchboards, also those used by linemen, repairmen and others in the various branches of the Company's business.

The American Company stood ready to furnish all instruments required for the furnishing of service and, to this end, maintained a stock at Chicago to meet present and future requirements. It also maintained a reserve supply to meet possible contingencies, such as conflagrations, floods, strikes, etc.

In addition to the instruments furnished to the Illinois Bell Telephone Company for actual use at subscribers' stations and elsewhere the American Company furnished, without additional charge, a number of instruments, equal to 3 per cent of those actually in use, to cover instruments in process of installation or temporarily out of service on account of subscribers' moves or any other reason.

The American Company repaired or replaced all instruments which might become defective or damaged, or were lost or destroyed, except through negligence of the Illi-
2481 nois Bell Telephone Company.

The American Company stood ready in addition to furnishing an adequate supply of existing types of instruments, to furnish any new and approved types which might be developed.

Under this arrangement, the Illinois Bell Telephone Company was saved the cost of all repairs and replacements and other charges in connection with Receivers, Transmitters and Induction Coils.

The following is an estimate of what it would have cost the Illinois Bell Telephone Company during the year 1923 to provide its own supply of instruments, purchasing them in the open market and providing a return of 8 per cent on the investment.

The regular instruments used at subscribers' stations in 1923 were sold in competition in the open market, at that time, for $4.65 per set. Instruments used at Central Offices and Private Branch Exchange switchboards are of a more expensive type.

The prices used in this estimate are somewhat below this on the assumption that the Illinois Bell Telephone Company might have been able to buy in quantity at somewhat below the open market price.

2482 The Instruments classed as "Instruments in the hands of the Telephone Company" include those in actual use at Subscribers' Stations, Private Branch Exchange switchboards, Central Offices and by employees for various purposes, together with those temporarily not in use, such as those in transit from warehouses, those in process of installation or removal, those in vacant premises, but not yet removed and those on hand for maintenance purposes.

Those classed as "Reserve Stock" represent additional instruments to insure continuity of supply and to meet emergencies.

I am informed and believe that such stock carried by the American Company for a number of years preceding the year 1923 averaged more than 6 per cent of the instruments in the hands of the Associate Companies. In the following estimate, 6 per cent is used, though for any individual company a greater quantity would be necessary to insure the same degree of safety.

The number of instruments used in the estimate is the average number actually in the hands of the Illinois Bell Telephone Company during the year 1923.

2483 INSTRUMENTS IN THE HANDS OF THE TELEPHONE COMPANY.

1.—*Central Office Operators' Sets and P. B. X. Operators' Sets—*

Average Number for the year 1923		Price Each	Cost
28,313	Receivers	$2.80	$ 79,276
19,023	Transmitters	3.00	57,069
18,341	Induction Coils	2.50	45,852
	Sub Total		$182,197

2.—*All others including Subscribers' Sets, Linemen's and Repairmen's Sets—*

690,731	Receivers	$1.90	$1,312,389
695,377	Transmitters	1.85	1,286,447
687,267	Induction Coils	.75	515,450
	Sub Total	$4.50	$3,114,286

SUMMARY.

3.—*Summary of Items* 1 *and* 2 *plus Reserve Stock—*

Total cost of Instruments in hands of Illinois Bell Telephone Company	$3,296,483
Plus 6 per cent for Reserve Stock	197,788
Total	$3,494,271

2484 4.—*Annual Charges.*

	On Instruments in hands of Telephone Co.	On Reserve Stock.
Return on Investment.....	8%	8%
Reserve for accrued depreciation	7%	...
Repairs	2%	...
Taxes	1.8%	1.8%
Contingencies and Insurance on Reserve Stock.....	2%	2%
	20.8%	11.8%

5.—*Annual Cost—*

$3,296,483 × 20.8% = $685,668
197,788 × 12.7% = 23,339

$709,007 A

Average Stations in Service—
Year 1923 ..... 660,927 B

Annual cost per station to the Illinois Bell Telephone Company if it should provide its own instruments at open market prices—

Item A ÷ B = $1.07

2.—General Staff Research and Engineering:

2485 The American Telephone and Telegraph Company maintains a large research and engineering staff continually studying the apparatus and methods used in furnishing telephone service. The work of this staff tends toward continued improvements in methods and equipment and leads not only to improvement in service and economical operation but also to standard and uniform methods which are necessary to provide the character of telephone service furnished.

The results of the work of this General Staff are available to the Illinois Bell Telephone Company in its operations,

without expense other than the payment under the License Contract. This makes it unnecessary for this Company to carry on similar work on its own account.

It is obvious that it is economical to carry on this work at one point for all the Associated Companies of the Bell System, not only on account of the avoidance of duplication, but also because there is available to the General Staff, the experience and results of all the companies in the United States. The General Staff also keeps in touch with developments in the telephone art throughout the world.

The work of the General Staff is not confined to scientific research and the development of new types of equipment, but it also studies and formulates actual methods of installation, use and operation in every branch of the business, going so far, in some cases, as the development and preparation
2486 of hand books written in simple language, with illustrations, for use of the field forces.

In addition to general studies, development, advice and information, the General Staff also studies and advises on specific problems, such as fundamental plans, location of exchanges, character of buildings and arrangement of large central offices, bringing to bear on such problems, the result of its studies and the experience throughout the country.

This is not confined to work in its office in New York, but representatives of the General Staff make many visits to Chicago for conference and study of its peculiar problems.

It is difficult to estimate the total value of these services but a few examples may be taken of specific development by the A. T. & T. General Staff of new and improved construction, material and equipment, upon which an estimate can more readily be made of the savings to the Illinois Bell Telephone Company effected by their use in its Plant in Chicago, as follows—

FINE WIRE CABLES:

The General Staff Engineers have carried on continuous development and research work in connection with the manufacture of cables, with the result that the number of conduc-

tors which can be included in one cable sheath has been
2487 increased from time to time, until at present as many as 3,600 wires can be included in one sheath. In the year 1923, as many as 2,400 wires could be included in one sheath, the number having been gradually increased by improvements in methods of cable manufacture from 200 wires, or less, which had been considered the maximum practical number.

By placing an increased number of conductors in one cable, large savings are made in the cost of the cable per conductor and in the number of ducts required. It is estimated that during the year 1923, the saving in annual costs secured by this means, amounted to at least $1,230,000.

USE OF LOADING COILS ON TRUNK PLANT:

By the use of Loading Coils it is possible to secure the necessary transmission by use of smaller gauge cable conductors than would be possible if unloaded conductors were used.

If larger conductors were used it would not only involve greater cost for the conductors themselves, but as it would be impracticable to increase the outside diameter of the cables, it would be necessary to include fewer conductors in each cable and, consequently, use more cables and also more ducts, thus adding further to the cost.

It is estimated that in the year 1923, the saving in annual cost by the use of loading coils, was $600,000.

2488 CABLE SHEATH ALLOY:

A telephone cable is made with a watertight sheath composed of lead with an alloy of some harder metal. Tin was at one time used for the alloy but as a result of extensive study and experiment, the General Engineering Staff developed a new alloy consisting of lead and antimony, which is considerably cheaper.

In 1923, the annual savings by the use of this new alloy, were at the rate of at least $45,000.

SWITCHBOARD CORDS:

The General Staff Engineers have given exhaustive study to improvements of the many parts going into the complete assembly of Central Office Switchboards, Private Branch Exchange Switchboards and Subscribers' Station Apparatus. One item which may be mentioned is the apparently simple piece of switchboard apparatus, the cord, which is used by the operator in making connections at the switchboard.

The early form of cord had tinsel conductors and was not very satisfactory on account of its short life. Later a cord was devised made with a steel ribbon conductor. This was put into general use and had a considerably longer life than the tinsel cord, but was less flexible.

For some years, this remained in use as the best cord 2489 available, but the study was continued and finally a new form of tinsel cord was developed, having a life equal to that of the steel cord, but having greater flexibility. These are now in general use and it is estimated that the saving by the use of this one item, amounted, in 1923, to over $330,000.

MULTIPLE ANSWERING JACKS

In connection with studies of the distribution of Traffic loads on the operators at central office switchboards, the General Staff Engineers devised a plan of providing multiple answering jacks. Before the use of these multiple answering jacks, was introduced, each line could only be reached by the operators in nearby positions, while with the lines multiplied in other positions of the switchboard, calls could be answered by a considerably greater number of operators. This resulted in making it possible to handle rushes of traffic with less delay and by fewer operators.

It is estimated that the saving in operating costs during the year 1923, by the use of multiple answering jacks, amounted to $330,000.

PRE-PAYMENT MULTI-COIN COLLECTORS

In order to care for the handling of toll calls, many pay stations are equipped with multi-coin collectors. Formerly, these were all of a "post-payment" type, without any
2490 provision for returning the coin. This made it necessary for the operator after securing the party called, to ask the calling party to deposit the coin, on local calls.

The General Staff Engineers developed a type of multi-coin collector of the "pre-payment" type, in the use of which the calling party deposits the coin before the operator calls the party wanted; the operator can then complete the call and collect the coin by simply pressing a key, or return the coin, if the connection is not established, by pressing another key. In this way, a very considerable saving of operating expense is made on local calls handled from multi-coin collectors.

The estimated saving for the year 1923, is $190,000.

PUNCHED FRAME RELAYS

One of the results of the studies by the General Staff Engineers of Central Office Apparatus has been an improvement in the method of manufacture of relays, of which very large numbers are used in the central offices.

A process of manufacture involving the use of punched frames has been developed which has resulted in greatly reducing the cost of relays. It is estimated that the annual savings in the year 1923, resulting from the use of this type of relay, amounts to at least $40,000.

2491 IMPROVED SUBSCRIBERS' STATION PROTECTORS

It is necessary to provide a protector at subscribers' stations to protect the apparatus and premises from lightning or in case of a cross between power circuits and open wire portions of the telephone circuit leading to the subscriber's premises. This protector while serving its purpose was, for many years, the source of a very considerable amount of interruption to service with consequent cost of restoration.

The General Engineering Staff developed a new type of protector which was equally efficient but which resulted in very much less interruption to service with consequent greatly reduced expense of clearing trouble.

It is estimated that for the year 1923, the saving by the use of this improved protector, amounted to at least $60,000.

Loading on Toll Cables

The savings estimated by the use of loading coils heretofore shown, apply only to the trunk plant within the City of Chicago. The same method is also applied to the toll lines within the City of Chicago, resulting in corresponding savings.

The estimated annual savings for the year 1923 amounted to at least $370,000.

Phantom Circuits and Duplex Cable

On open wire circuits it has, for many years, been
2492 practicable by the application of certain equipment at
the end of the circuits, to secure from each two physical circuits, a third circuit known as a "phantom" but this was not practicable on cable conductors on account of cross-talk.

The General Engineering Staff, however, developed a form of cable known as "duplex" cable, which made it possible to secure phantom circuits in cables without interference. The result of this has been to make possible the provision of one phantom circuit for each two physical circuits in toll cables, thus reducing the number of physical circuits required.

It is estimated that the annual saving in the year 1923 in toll plant secured by this means, amounted to at least $25,000.

General Summary

In the foregoing are mentioned only some of the benefits received by the Illinois Bell Telephone Company in return for the annual payment which it makes to the American Company under the License Contract.

The following statement shows the value of that part of

the services including the furnishing of instruments and those items connected with the equipment and outside plant which have been referred to in some detail and which were in use in the City of Chicago in the year 1923:

Cost per Station per Annum to the Illinois Bell Telephone Company if it should provide its own instruments	$1.07
2493 Annual Saving by	
Fine Wire Cable	$1,230,000
Loading on Trunk Plant	600,000
Cable Sheath Alloy	45,000
Improved Switchboard Cords	330,000
Multiple Answering Jacks	330,000
Prepayment Coin Collector	190,000
Punched Frame Relay	40,000
Improved Protector	60,000
Toll Line Loading	370,000
Toll Line Phantoms	25,000
Item A—Total	$3,220,000
Saving by Item A	
Divided by average number of stations in service in the year 1923 = $3,220,000 ÷ 660,927 =	4.87
Total estimated value of service and items enumerated above, per station, for the year 1923	5.94
Payment by the Illinois Bell Telephone Company to the American Company under the License Contract, per station, for the year 1923	2.61

The figures which have been given are not a full measure of the value of services furnished by the General Staff of the American Company. They cover only a few items and
2494 any estimate of the service which took them alone into account would entirely underestimate its value.

While the savings above referred to amount to more than twice the amount of payment to the American Telephone and Telegraph Company, under the License Contract, I believe

that even more important are the benefits from the work of the General Staff which cannot be measured in dollars. Among those which cannot be evaluated are:

(1) Great benefit to the public in the high degree of advancement of the telephone art and science in the United States, which I believe could only have been attained through a centralized General Staff.

(2) The assurance that through continuous research the art and science of telephony will continually progress.

On December 31, 1927, the Illinois Bell Telephone Company acquired all the instruments used in its service in Chicago and since that date, no instruments have been furnished by the American Company.

The payment under the License Contract has also been reduced so that for the year 1928, it was based on 2 per cent instead of 4½ per cent of the gross revenue.

The payments for the year 1928 amounted to $1.20 2495 per station for the average number of stations in service.

All the services, except the furnishing of instruments, have, however, been continued and as the plant has increased since 1923 substantially in proportion to the increase in stations, the total value of these services has also increased in substantially like proportion so that the same figure of $5.84 per station may still be taken as a fair estimate of the savings by the specific items mentioned.

A comparison similar to that shown for 1923, for the year 1928, would be as follows:

Saving by items specifically mentioned..$4.87 per station
Payment under License Contract..... 1.20 per station

The services under this contract are essential to the Illinois Bell Telephone Company to enable it to render the best and most efficient service in Chicago upon the most economical basis.

It would cost the Illinois Company, if it were possible to do so, much more to perform for itself the services now ob-

tained from the American Company than it pays the American Company for its services.

The development of improved apparatus and methods and the resultant efficiency and reduction in cost of production, construction, operation and maintenance, could not be realized on the present scale, except through the centralized
2496 development and research work of the General Staff of the American Company.

2497 *Cross-Examination by Mr. Haight.*

In my direct testimony, I stated that the American Company retires or replaces all instruments which may become defective or damaged or lost or destroyed, except through the neglect of the Illinois Bell Telephone Company. The instruments that were damaged or needed to be repaired are replaced from the Western Electric Company branch house in Chicago. The stock that was kept on hand at all times was kept in the Western Electric Company branch house in Chicago.

In the computation made in regard to the prices of instruments, I used prices just a little below what I believed from the best information that I could get, would have been
2498 the open market prices. If I had used the prices to which the Associated Companies of the Bell System are entitled, the annual cost per station would have been somewhat lower. I don't know how much.

I took 8% return on the investment because I thought that was a fair return to get on the investment. That is my own idea of what a fair return would be and I think it is the figure that is generally used. It did not come from any other source. I don't know what the A. T. & T. paid for these instruments in 1923. I didn't testify before the Commission and don't know anything about how the A. T. & T. bought these instruments.

2499 I believe the Illinois Bell had a contract in 1923 with the Western Electric to purchase at the prices given the most favored customers. I have not the figures as to the

price the Illinois Bell paid the A. T. & T. in 1928 for the instruments bought from them.

The 6% reserve stock is entirely apart from those we have or those carried for current purposes at the branch
2500 house. The 3% is in the hands of the Telephone Company and is not a surplus, but covers instruments in the process of installation, not yet removed, being transported, etc. As a matter of fact, we usually have more than 3%. I don't think I can state how much more in figures.

I do not know anything about the actual division between the Western Electric and the A. T. & T. of the expense of research and development in manufacturing methods, and don't know exactly where one stops and the other be-
2501 gins. I am not the one of the local company who is expected to know the most about that and I don't really know who is. Perhaps Mr. Hale, the vice-president, might know more about that.

I think the results of the research and development done by the Western Electric Company would be available to the A. T. & T. I don't know whether the A. T. & T. pays the Western Electric for any research and development work on any apparatus that is done in the Western Electric factories. I never tried to find out.

2502 Occasionally some man in the local company makes some suggestions for an improvement along some lines; it is usually a rough idea and such cases have been referred to the American Company. That company has done whatever work has been done in respect to it. Only in a general way do I keep in step with the development or the progress of the art of telephony. I think I make no conscious effort to do it, but I naturally know about new developments that come along and read articles on various things occasionally and talk with people about things from time to time.
2503 That is all. Our men very often go to New York. I do not recall any cases where I would say that they went to assist the people there. They usually go for the purpose of getting information and discussing problems which they may have.

I do not know anything particularly about the development of fundamental plans as applicable to Chicago. I know that the American Telephone and Telegraph Company has considered the way in which fundamental plans can best be made, and I believe that our engineers who handle the making of fundamental plans have consulted with the people on the general staff who pay particular attention to that part of the work. We have our own fundamental plan engineer who works out a fundamental plan for Chicago, receiving such assistance as he may from the A. T. & T. I don't know
specifically what assistance he gets from the A. T. & T.
2504 Generally I think the assistance is along the line of discussion of the best way to proceed with such plans.

I do not know that the independent companies began working with fine wire cables before the Bell System did. In getting the figure in savings of annual costs of $1,230,000 to the local company, I was making a comparison of the annual charges of what we had compared with what would have been the annual charges on 19 gauge cable necessary to provide
the same conductor mileage. The comparison is between
2505 22 and 24 gauge cable on the one hand and 19 gauge cable
on the other hand; with the numbers of conductors which it has been possible to place in the sheaths. The comparison was between the annual charges on the fine wire cable which we had and the estimated annual charges on the other cable which would be necessary to provide the same conductor mileage. It was necessarily all worked out on paper. The papers are at the office. Although I am not quite sure, I think that in making this computation I assumed that all the cable in 1923 that was in fact 22 and 24 gauge, would be 19
gauge, short runs and everything. I do not know ex-
2506 actly, but I am pretty sure other manufacturers do not
supply any 1800 pair cable or any 1200 pair. I don't know whether Roebling Company supplies 1200 pair cable. I don't think they do.

I have computations on the use of loading coils on trunk plant, but not with me. The figure $600,000 for the year 1923 is the difference in the estimated annual costs of the loaded

cable which we have and the larger gauge cable which would be necessary if we did not have the loading coils. Of course, it includes costs for additional conduit that would be necessary, because there would be more cables. The figures
2507 are entirely on trunk cables between exchanges. There might be some exchanges which have trunks between two particular exchanges which do not require loading coils. There would be no whole exchanges that would not have trunks that were loaded. As I remember it, I think it was based on the entire cost of loaded cable. That is, the coils were not figured separately; it was the cost of loaded cable. I think the kind of cables I had as factors in my computation when I arrived at the $600,000 was mostly 19 gauge. There might have been some 22 or 24 gauge. I don't think there was any loaded. There might have been some small lengths. I
2508 am not sure. I assumed wires of the various sizes necessary to give an equal transmission. I cannot tell you the sizes I assumed and will have to refer to the papers. That particular thing was figured out by Mr. Rhodes and the Engineering Department. I know that 13 gauge was used and whether any larger I am not sure. I have a pretty good picture of what 13 gauge looks like. I cannot tell you the diameter. I do not know how many times heavier per
2509 lineal unit 13 gauge is than 24 gauge. I don't think it is as much as 8 times heavier per foot. Assuming it is 12 times as heavy, or thereabouts, I compared the cost of smaller wires with loading coils against the cost of wires 12 times as heavy. If that assumption is correct, the on such a comparison I think that I, or somebody for me, found out how much more this vastly heavier wire would cost. The saving is the difference between the cost, that is, the annual
2510 charges on the difference. I am not sure that we did stop at 13 gauge. We tried to get the thing we would have to use to get a satisfactory transmission if we did not have the loading coil.

I have the computations at the office as to the saving of $45,000 on cable sheath alloy to the local company for the

year 1923. Briefly, $45,000 is the total difference between the annual charges on the total amount of tin there would be in the plant under the use of the old alloy and the cost of two pounds of lead and the one pound of antimony
2511 with which it was replaced in the new alloy. We simply figured the difference as I have just described. We took the amount of antimony—I think we arrived at it from the antimony now in the plant.

Before the lead and antimony sheaths were used, a combination of 97% lead and 3% tin was used. Later the composition of metal made up of 99% lead and 1% antimony was used. I believe there have been some changes made in the thickness of the sheath. In making my comparisons I did not take into account the fact that there was much less
2512 material in the later sheath than there was in the earlier sheath. I don't think that has anything to do with it. We made no assumption as to the total weight of the sheath. If, on account of the difference in weight there was a difference, I did not take any account of that because I did not take the total weight. The saving on this item was
2513 $45,000 and not $600,000. I arrived at $45,000 by taking the figures and rounding them out to round figures. I did that in all cases. I have not the exact figure with me in the case of the cable sheath alloy.

I have preserved my working sheets in reference to switchboard cords. I think we can find all our papers on all of this. I have seen the earlier form of cord with tinsel conductors. These cords wore out rather quickly in use.
2514 Then a cord was made that was provided with a steel ribbon conductor, a steel wire of some sort in it. That cord had a longer life but was not as flexible, not as satisfactory for use on that account. I do not know who recommended the use of the tinsel cord. That was long before my time. I don't know whether it was the A. T. & T. or not. I am fairly sure that it was the A. T. & T. that recommended the use of the cord with the steel ribbon in it. They made further improvement in the tinsel cord and recommended

that we go back to a different style of tinsel cord. It was
from tinsel to steel and then from steel to tinsel again.
2515 I think in figuring the saving I jumped right from the
original tinsel cord to the present cord, and the saving was figured out on the basis of the longer life of the cord. Mr. S. A. Rhodes did the detail figuring on that. I jumped entirely the cord with the steel ribbon in making the computations. I didn't jump the first tinsel cord and I did not know what to jump to before that. I would not necessarily have
jumped the first tinsel cord if I had known. We took
2516 the cord that was in general use quite a number of years
ago and disregarded the intermediate development and compared the cord that was in general use quite a number of years ago with the cord that is now in use. I don't know but I do not think the use of the steel ribbon cord increased the operating expense over the early tinsel cord. I think it was a saving.

One of the difficulties of the steel cord was, it was more difficult for the operators to get the plugs in and out of the jacks. They did not come to position as readily, but it was a question of degree. I think the steel cord was not as satisfactory as the old tinsel cord from one point of view but
was considerably more satisfactory from another, and
2517 over all I think it was probably a more satisfactory
cord. I do not think there was any loss on account of the intervening cords with the steel ribbons. The sum of the whole thing is this: We have split this saving into two parts; first the saving from the old tinsel cord to the steel ribbon cord, and then the further saving from the steel ribbon cord to the new tinsel cord. But we did not do that, we put it right through. I never figured it, but I believe there
was a saving going to the steel ribbon cord. I am not
2518 sure it was the longest jump I could take. I do not per-
sonally know anything about any cord previous to the one with which we compared it. If there were cords before that, no doubt we could get figures on it.

As to the wire in the cable, we went back to a size of wire

which would be big enough to give equivalent transmis-
2519 sion. I think the largest size to give equivalent trans-
mission, on which I based my calculations, was 13. I think 13 is the largest size we used.

The saving of $330,000 in the case of multiple answering jacks and $330,000 on switchboard cords happened to be two figures just alike. In figuring the saving by the use of multiple answering jacks, the Traffic Department was able to give us a figure representing the operating cost with and without multiple answering jacks, expressed in thousands of work units which had a definite value, so as to be reduced to dollars. From that we deducted the cost of the additional equipment involved in the multiple answering jacks, less the value
2520 of a certain number of positions which were saved by the fact that we could have less operators and consequently require less positions. In that, we arrived at the net difference and net saving which we made by the use of the multiple answering jacks. I don't know who prepared those traffic figures. They were prepared back in 1923 and I used the same figures. I did not prepare the information as to the numbers in use, etc. That was also prepared back in 1923 and I used the same figures. I went over all the figures and discussed them with people who knew something about them; particularly with Mr. Rhodes, who had a great deal to do with originally preparing them, and drew
2521 some conclusions from them and arrived at the final figures. The basic data is based upon what somebody else told me in each case.

The saving of $190,000 in 1923 on prepayment multi coin collectors was also arrived at on the basis of traffic department figures, showing the difference in operating cost in handling the calls over the old post payment boxes and over the present pre-payment boxes. There was an increase in the cost of the boxes, I think, and there was also a decrease in the number of positions required, on account of requiring fewer operators, and they just about offset each other. I did the figuring myself in respect to this item only in the way

of going over the figures and discussing them. I did
2522 not know that multi coin collectors were first developed by independent companies. My answers would be the same if we assume that in the case of one item covered by me that that item relates to a matter that anybody can use and that the A. T. & T. and the Western Electric Company have no patents.

The relays were originally made of rods and plates fastened together to form the frame of the relay. A method was developed of punching out these frames, which gave a smaller frame and a cheaper relay. Those were pur-
2523 chased from the Western Electric. The difference in price between the old machine tooled relay and the punched relay charged by the Western Electric is the way the saving was arrived at for this item. I think the facts all came from the records of the company. They were also prepared by Mr. Rhodes, who made the figures. After Mr. Rhodes gave me these figures we changed quite a few in the way of the conclusions which we drew from the figures rather than the actual calculations. When I say "we" I am speaking of my conferences with Mr. Rhodes, and mean that Mr. Rhodes and I together changed some of the figures.

The estimate of $60,000 savings on improved subscrib-
2524 ers' station protectors is my estimate to just the same extent that all the others are, based upon the figures which I have spoken of. That figure is a computation of the saving in cost due to the smaller amount of trouble which occurs on the new type compared to the old type. I do not know Mr. Cook of the Cook Electric Company. I know there is a Mr. Cook and I have heard that he developed subscribers' station protectors. I did not know anything about a suit somewhere around 1910 by Mr. Leeper against Mr. McBertha, engineer of the Western Electric Company, involving a patent on protectors. I do not know of that patent having been taken over by Mr. Cook while Mr. McBertha was the Western Electric man. I do not know that the Western Electric Company developed protectors so as not to conflict with those Leeper

patents and in order to compete with the Cook Electric
2525 Company. I do not know anything about that. I did not try to find out anything about that or any similar thing in arriving at the estimate I have made. I simply took what I estimated to be the difference in the cost that we did have compared to what we would have had, had these
2526 various items not been developed.

I do not assume that the mere mention to the local Company by the A. T. & T. is sufficient to warrant me in figuring these savings. I assumed they became available for our use and we used them. I should say in addition to that, while I may not be able to point to specific facts in each case, I believe that the things I have mentioned did become available through the work of the general staff. In making
2527 these estimates of savings I have not taken into consideration where the general staff got the instrumentalities used by the local company or how they got them. If the general staff should recommend a first class Underwood Typewriter to me, I would not figure how much value that service had been to the company by determining what it cost to write longhand as compared to the service of the typewriter. I consider that an unfair analysis of my testimony and an unfair analogy. It is unfair because the typewriter is something entirely outside of the scope of the work of the
2528 general staff, I should say. I don't know just what they have done in each individual case, but the things I have been speaking of have certainly been matters of earnest study, experiment, etc., on the part of the general staff. We use typewriters in the business of the local company. If the general staff recommends the use of the typewriter, it would not be a fair proposition to determine the worth of that recommendation to the local company by comparing the value of the typewriter with the costs of writing longhand.

The saving of $370,000 for the year 1923 on the loading toll cables was arrived at in the same general manner as the figures on loading of trunks. That is, it is a comparison of the annual charges on the loaded plant that we have com-

pared to what we would have to have in unloaded plant.
2529 Mr. Rhodes prepared those detailed figures also. The figures given in here are only on the Illinois Bell toll lines within the City of Chicago. We simply took the mileage within the City of Chicago and did not bother about the rest of the state. In each of these items I have confined the savings to the City of Chicago.

Phantom circuits are not employed in local service in the City of Chicago. The saving of $25,000 a year is the saving made in the toll lines within the City of Chicago by the fact that we have used phantom circuits. I find that the
2530 total savings on the items I have mentioned for the year 1923 was $3,220,000 exclusive of the instruments. I don't know whether it is a question of the value of the services. It is a statement of the estimated amount which we saved because we did receive those services. I did not say anything about the value of the services. The $3,220,000 is what we saved the Chicago property of the local company because we had the services.

2532 I think it is very difficult to answer the question as to whether this represents an estimate of the fair value of the services in respect to the particular items I have referred to. I have not made any attempt to evaluate the
2533 whole services or any particular service. On the whole, I have no opinion as to how much in dollars the services rendered by the A. T. & T. Co. are worth to the Illinois Bell Telephone Co. I have no specific opinion in respect to the value of the specific items I have referred to. If by the value you mean what ought to be paid for them, I can only say that we did save that much by these services. I have no opinion as to their value which I can express in a definite monetary term. The statement I made "The following statement shows the value of that part of the services including the furnishing of instruments and those items connected with the equipment in outside plant which have been referred to in some detail and which were in use in Chicago in the year 1923" together with my tabulation summed up with the total

$3,220,000 is, I think, an incorrect statement. I think
2534 I should have said, "the savings accomplished by those items." I wrote that statement myself.

2535 *Re-direct Examination by Mr. Bangs.*

2536 I got the basic data underlying the valuation of these items from Mr. Rhodes and went over the figures item by item, and then discussed the way in which the figures had been made with Mr. Rhodes, and the conclusions which had been drawn from them. I asked him to get some more data in some cases and we studied them and discussed them for a considerable time and finally arrived at figures that I was satisfied to use. I am responsible for these figures to the same extent as if I had made the calculations myself. I could hardly have made all these calculations myself.

I think my statement, "the following statement shows the value of that part of the services including the furnishing of instruments and those items connected with the equipment in the outside plant which has been referred to in some
2537 detail" would be better expressed if it said "The following statement shows the savings realized by the Illinois Bell Company from that part of the services."

I have a judgment as to the value of these services as compared to the amount we pay for them. It seems to me that they are certainly worth more than we pay for them, because the savings which we have shown here for a small part of the services are so much more than the total amount we pay
2538 that it would seem as if the services must be worth all and probably considerably more than we pay for them. I have not enumerated any commercial services, any traffic services, any accounting services, or any financial services. All that I have done is to take items regarding plant which were capable of arithmetical estimates based upon the difference between the operating expenses if these developments had not taken place and the operating expenses under the new apparatus.

I think we use several kinds of typewriters and buy them under a contract made by the Western Electric with the
2539 typewriter concern under which they get a discount. I do know some department of the A. T. & T. Co. has considered the question of the most efficient typewriter and I think a report was made on the subject, but I was not particularly interested in it and just know it from more or less hearsay. It is possibly not impossible to suppose the A. T. & T. Co. should get control of all of the patents involved in the typewriter and develop a new type of machine into which you could speak audibly as you do over the telephone and it would come out in the other end of the typewriter in typewritten form. After they had developed that and made it available and we had used it and I was then called upon to determine the saving resulting from the apparatus developed by the general staff I might take that into consideration. I suppose I would take into consideration the difference in the cost of producing the letters by the two means.

2540 It seems to me that is what I have done as to the apparatus that has actually been developed by the American Company. I have not taken into consideration the fact that if there had not been any A. T. & T. Co. this local company might have got a good deal of this from some other source. Of course it would have cost something to do that.

2731 F. O. HALE, recalled as a witness in behalf of the plaintiff, in rebuttal, testified:

Direct Examination by Mr. Bangs.

My name is F. O. Hale, my address 212 West Washington street. I have been sworn. I am Operating Vice-President of the plaintiff and have testified before.

2732 (Plaintiff's Exhibits 73 and 74 marked for identification.)

I had Plaintiff's Exhibits 73 and 74 prepared. An organization chart is an attempt graphically to show the lines of authority and the general set-up of the organization. It in-

dicates to whom different departments report, and in general indicates the line of authority.

The chart for July 1, 1928 (Exhibit 73), starts with the president and indicates by the lines that there is reporting to him the General Counsel, the Secretary and Treasurer, Vice-President in charge of operation, Vice-President in charge of personnel, Vice-President in charge of accounting work. Following down below that, it shows that the Vice-President of
2733 operation has reporting directly to him a general manager in charge of the Chicago area; one in charge of the state area. It shows that the Publicity Manager reports to the Vice-President in charge of operation and that the Assistant Vice-President and Superintendent of Claims also report to him. They are indicated by the lines. The numbers under the names of the different officers indicate the total number of officers and employees reporting to that particular person.

The President is in general charge of the operations and functions of the Company, subordinate, of course, to the Board of Directors. Reporting to him are the General Counsel, who has charge of the legal aspects of the Company's business; the Secretary and Assistant Treasurer, whose duties are those commonly assigned to a secretary. I think it is pretty generally understood what the secretary's duties
2734 are. I won't attempt to amplify any further than to general duties of the secretary.

A vice-president in charge of operation, who has general charge, under the president, of all the operations of the company other than the legal, accounting and treasury operations.

A vice-president in charge of personnel relations. His duties are generally the relations between management and employes, to be sure that no rough spots develop that are not smoothed out if they can be. He has charge of the Health Department. He is chairman of the Benefit Plan and in that way has charge of the administration of the Benefit Plan.

The Illinois Bell has its own Benefit Plan organization. That is the uniform plan throughout the Bell System, administered, however, separately by each of the Associated Companies.

There is also reporting to the president a vice-president in charge of the treasury and accounting activities of the company. He has reporting to him the treasurer and assist-
2735 ant secretary and the general auditor.

The general auditor has reporting to him an auditor of receipts, who has 987 employes; a chief accountant who has 20 employes; an auditor of disbursements, with 182 employes; and a chief traveling auditor with 6 employes. The number of employes as I read them was as of July 1, 1928, the date of this chart.

The auditor of receipts is in general charge of the accounting practices and the accounting measures involved in keeping a record of moneys coming to the Company. He has charge of billing, the preparation of the bills to subscribers and all of the work involved in keeping these individual accounts correctly and getting the bills out.

The duties of the chief accountant are of a staff nature. He has general charge of studies of accounting methods, statistical information, and matters of that sort.

The duties of the auditor of disbursements are confined to the keeping of the general books of the Company and the keeping of accounts involved in payments made by the Company.

The chief traveling auditor's duties are the checking up of employes throughout the field who have cash advances,
2736 examining their methods of keeping their petty cash records and making sure that everything in connection with those petty cash advances and the payments made from them is done properly and properly accounted for.

As operating vice-president, I have reporting to me two general managers; one who has charge of the Chicago area (and the Chicago area is the City of Chicago), who has 21,157 employees reporting to him.

There is a general manager who has charge of what we call the state area, which is all the rest of the territory operated by the Illinois Bell Company. On July 1, 1928, 8,703 employees reported to him. These men have charge of the

day-to-day operations of furnishing telephone service to the public within their areas. I will take up the subdivision of the work under them a little later.

In addition, I have reporting to me a Publicity Manager, whose duties are principally in connection with advertising, the preparation of advertising copy and the placing of it.

That also covers such advertising as we do through
2737 window displays in our own buildings. We have many of them in our commercial offices. He also has charge of the Company organs, "The Bell News," which is a company magazine issued monthly and the "Weekly Supplement of the Bell News." The purpose of that is to keep the employees informed of the activities occurring in the Company, giving them advice as to measures being undertaken by the Company, new developments in the business and things of that sort.

There is also reporting to me an assistant vice-president (Mr. Redmund), shown here with 15 employees. I think he has testified in this case. His duties are as general assistant and apply particularly with reference to correlation of activities in the two areas. There are many questions that arise, the question arises whether both areas shall be carried on the same or whether there shall be differences, and it is the solving of such problems that he is principally engaged on, in addition to acting as general assistant.

Then there is the superintendent of claims reporting to me with 65 employes. His duties involve the investigation of all claims against the company and all claims of the company

against others, of which there are a great many, arising
2738 out of the daily operations of the company. There are automobile accidents resulting in claims against us and claims by us against others. All of our construction activities are liable to lead into claims in one direction or the other; the construction activities of others affecting our plants lead to claims by us against them. His duties are the investigation of these claims, securing the facts, and rounding up the story for the assistance of the legal department, if the case has to

go that far and we cannot settle it on the basis of the investigation as it develops.

The general manager of the Chicago area has reporting directly to him four main groups of employes, each group headed by an individual. There is the chief engineer, general traffic manager, general commercial manager, and the general plant manager. Within those four functions there is
a complete organization. Those four functions cover
2739 everything that is necessary and everything that is involved in starting with no telephone plant and building a telephone plant; attaching the subscribers, providing the operators for furnishing the service and the maintenance of the organization for maintaining that plant. I will, in the interest of conserving time, be as sketchy as I can and still give an accurate picture.

The chief engineer's duties are the general correlation of the design of that plant. He does not do all the engineering of the plant, but it is his function to see that it is laid out in such a way that the other departments, in so far as they get into engineering principles, do their work in such a way that you get a correlated whole, which will furnish service in the most efficient and best way. He does directly handle the engineering of central office equipment and of the buildings for carrying on these functions.

The chief engineer has reporting to him a fundamental plan engineer, whose duties are to determine where central offices should be built. That in itself is a large task, as it involves a prediction as to future growth of population, as to where that will be located, insofar as it is possible to make it, and
the final determination of what is the proper point for
2740 the location of the central office; and in a given area, how many central offices you shall have to provide and the most economical plan for furnishing telephone service to that area.

I cannot tell you exactly how many central offices the Illinois Bell has in Chicago. There are something over thirty central office areas, what I call a central office area, and within those areas there is an average of perhaps three units in

each area. There is something like 90 units in Chicago as I remember. That does not mean a separate unit in each office. They average, I think, about three units to a building and I think there is something like 30 or 35 separate buildings. That is just a rough picture of the situation and is approximately correct.

Now in addition to the fundamental plan engineer, the chief engineer has reporting to him a transmission engineer: His function is to see that the proper size conductors are provided, both between central office areas and from the central office area to the subscribers' substations, with the proper loading coils that can be used on trunks, with the proper special transmitters, where they do the work, so that each subscriber to the system can talk to any other sub-
2741 scriber to the system, and also have the subscribers' routes so provided that there is not an undue transmission loss there in connection with toll service. He has to watch that continuously and advise the plant department—the other departments provide the equipment—as to the proper balancing of losses. There have to be some losses and it is a question whether he shall take them out through the equipment or whether he shall take them out through conductor size or through loading or various other methods. The transmission engineer is making tests all the time of the amount of telephone service and the amount of transmission losses.

The Chief Engineer has an engineer of buildings: His function is in connection with the erection of new buildings and additions to old buildings, as it becomes necessary to expand them, preparation of plans and dealing with the architect and then dealing with the contractors for the carrying out of those plans and the final erection of the building.

A maintenance engineer, whose duties are largely of a consulting nature in connection with special problems of maintenance that may and do arise from day to day, questions of the best methods of maintaining plant apparatus—
2742 there are new developments in the apparatus all the time and there are questions of just how they can best

be maintained, the question of whether it is functioning properly, and he is rather expert on maintenance questions of that type.

Then there is the equipment engineer. As I said before, the chief engineer is responsible for the engineering of the equipment or getting it in place, and the equipment engineer reports to him and takes care of that activity.

The chief engineer also has reporting to him an outside plant engineer, whose duties are in connection with the general designing of outside plant, reviewing outside plant estimates as they are prepared by the plan department and inspection of them with the chief engineer to see that they fit properly into the total picture, to work those plans into the total picture that will provide adequate plant for rendering service.

2743 The general plant manager has general charge of the construction of the physical plant outside of the buildings and the central office equipment, construction of the outside plant, cables, underground conduit, installation of telephones in the subscribers' premises after the order has been received, the maintenance of all this plant, including the maintenance of the buildings, equipment, and the outside plant. He has charge of the accounting work as far as the plant accounting extends. The accountant who covers the plant accounting, the plant that is put in and taken out, and changes in the plant, reports to the general plant superintendent. Instructions to that plant accountant are issued by the general auditor.

Now to carry on these activities, the general plant manager has the Chicago area divided into three divisions: Central Division, North Division, and South Division. People in those divisions are engaged in the maintenance of plant, both inside and outside, in the installation of service for new subscribers, for subscribers who move, the removal of
2744 telephones for subscribers who discontinue the service and the general function of keeping the plant working, the plant that is engaged in giving service to subscribers that are attached.

He also has a division plant superintendent, handling the long lines plant, and both the central office and outside plant that lies within the City of Chicago.

He has a superintendent of construction and plant engineer: His duties are the designing and initiation of engineering projects for conduit, underground conduit, underground cable, aerial cable, pole lines and everything of that general type that is involved in providing plant to reach from the central office to the subscribers' premises, wherever they may be. To carry out that function, he has twelve or fifteen district engineers, who are charged with the responsibility of initiating engineering projects for the plant within their district.

Then he has a superintendent of construction. After the work covered by these estimates has been approved by the officers of the company and the board of directors, it goes to the superintendent of construction as a project to be carried out to provide the physical plant called for by these plans.

The superintendent has charge of the construction people who carry out the work involved in keeping the plant
2745 up to date and adequate for the giving of service in Chicago.

Then there is reporting to him a plant accountant, who receives his instructions from an accounting standpoint from the general auditor, whose function is to keep track of the changes in the plant and the changes in the books that are involved in connection with these plant activities which I have been describing.

Then there is a superintendent of buildings, supplies and motor equipment. He has general charge of our buildings, both owned and leased, has charge of the upkeep of our owned buildings; is charged with the duty of making leases where we need space and that seems to be the proper way of providing it. He is the point of contact between the Western Electric Company and our forces on supplies. He takes those supplies as they are turned over at the warehouse to the telephone company and distributes them to the different plant

people who are going to use them at the predetermined points where they want them; and he also has general charge of the purchase of motor equipment and maintenance of motor equipment.

Then he has reporting to him an employment supervisor.

This general plant manager has 6,577 employes. The
2746 change and turnover in the force is considerable. It involves plenty of work for one man to keep track of it. New men coming in have to be trained. The employment supervisor has general charge of the schooling of these employes. He is charged with the study of what causes turnover, if there is anything in the relationship between the employes and management that may be causing more turnover than necessary; he is watching that. In a business like ours, which goes so intimately into the life of our patrons, if you are going to do a good job it is particularly important that your employes be satisfied and happy and feel that they are being properly taken care of. We pay considerable attention to that.

Then there is reporting to the general plant manager also a general plant supervisor. That is a staff activity for the general plant manager and involves the study of the different people in the plant department, how well they are doing their jobs, what results they are getting from month to month and quarter to quarter, and year to year, bettering the job, instead of going backward. The plant supervisor develops routines for handling the plant work. There is a large number of them involved. The plant department touches all the other departments and the whole thing has got to fit together so that
2747 from the standpoint of the company it is a company and not a lot of disjointed departments.

There is a general traffic manager. His functions are in general the provision of the operating force, girls and operators, the preparation of instructions under which they proceed, and the preparation of the operating rules under which they carry on their work. It is his function to see that there are enough of them at all times at the switchboard to handle

the number of calls which may come in. He has charge of them all the way through. He has charge of hiring them, of the estimates as to the number it will be necessary to hire and have ready at any given time. He has to watch the losses and so forth.

He also has charge of the initiation of recommendations of plans for adding to central office equipment. That is where the problem starts. There is no use in having an operator there unless you have a switchboard position for her to
2748 sit at and work at, and there has got to be enough switchboards. So that he is charged with the initiation of recommendations of additional switchboard and the planning of that switchboard from a traffic standpoint, that is, from the standpoint of seeing that it is designed to give service in the position in which it is going to be located.

I could not say exactly how long Mr. Meyer has been with the company, but I think approximately forty years. On July 1, 1928, 13,046 employes reported to him.

Now, his work is organized under a division superintendent, covering the long lines operations in Chicago and then three division traffic superintendents, who parallel the plant division superintendents whom I mentioned a short time ago; and their work is again subdivided into districts under each division superintendent; and in general they have charge of the functions involved in seeing that the public, who are subscribers, at the given time get service, that the operators are there, that the operating methods meet the situation and that so far as possible the work of the operators is satisfactory to the patrons.

Now, he has two staff men—he has a traffic engineer also reporting to him, whose duty is to initiate these recom-
2749 mendations for equipment, switchboard, and trunks between the different units, which I mentioned a short time ago.

Then he has a staff supervisor, a general supervisor of traffic. The activity is a staff activity. His duty is to study continuously the results of the traffic department, study the

quality of service being rendered. The school reports through him, that is, there is a considerable turnover in a force of 13,000 girls, new ones coming in, they have to be trained, they have to be taught how to operate, estimates of the number of employes required have to be made; as it takes three weeks or a month to get them through the operating school you have got to figure three or four months ahead on your requirements, because you have got to have a trained employe there in order to give the service. He watches all those estimates which are made by the different districts as to the number of employes they will need at different periods, correlates them, and then sees that the school hires enough green employes so that they will graduate the adequate number of people as operators.

A very important part of the activity of the traffic department is the making of studies to determine the variations in the traffic load and the variation that would arise from any sort of emergency, such as a Republican Convention, or
2750 matters of that kind. It is necessary to anticipate fluctuations in traffic due to anything which may take place. It is necessary during the football games in the fall or other big sporting activity. The question of baseball scores puts a special load on our whole plant about the time of the games, around four or five o'clock. All those things have to be watched continuously, estimated as best we can and special provisions made for them.

The word "staff" as I have used it in general is an activity which involves the study of methods and results. The people doing that are relieved of what I call direct line activities. They are not supervising people, whose business it is to take care of the public directly, whose principal function is to care for the public, whatever the public may want at that particular time; but rather, they are a detached group who are studying the activities of the company from the
2751 standpoint of the adequacy of the service, the satisfactoriness of it, whether it can be improved, whether the cost of it can be reduced and all that type of thing. They

are detached from the line activities and the day to day movements as far as the subscribers are concerned.

Now, the commercial department, which is the very general activity under the general manager,—the general function of that department is dealing with the public, with the subscriber who wants service, taking his contract, writing the order for the installation of the telephone, the collection of bills as they have been rendered by the auditor of receipts; the collection of the moneys from the public, from the patrons; and any other special activities that are involved in that general division of the work. It is the commercial aspect of the business. Perhaps it would be clearer to consider the organization of that department.

In the first place, the line activities of that department are handled under three division commercial managers. They are parallel to three divisions that have appeared in the plant and traffic departments. They have the same areas and
2752 the employes under those divisions are again subdivided into districts.

Then the general commercial manager has a general sales engineer. His activities are consideration of means to further sell our service; what service have we perhaps not been pressing on the public, whether the extent to which it is used by that part of the public which already have it, indicates that it should be pushed and developed.

His activity is the general consideration of what can be done in the way of selling. We do not have a big sales force but we do endeavor to do enough sales work to meet the needs of the public, to explain to them where our telephone service can be advantageous and of further use to them, without overdoing the proposition.

He has a special contract agent reporting to him. His duties are specially the handling of special forms of service, like dealing with the railroads, whose service is very special. They use the telephone largely in the operation of their trains, require special equipment and special layouts.

The special contract agent also handles telephone typewriter service, which is a new development with us.

Telephone typewriter service is a device whereby you
2753 can reproduce on the typewriter at a distance, be it five miles or five hundred miles, a letter or message. It comes out at the other end in typewritten form and gives you a written record at both ends.

The directory superintendent handles the preparation and issuance of the directories. The directory, of course, is a very necessary thing in connection with telephone service. We issue two directories a year in Chicago, about a million copies of each issue. There is a general suburban directory issued once a year. And then this directory superintendent is a common employe with the state area and handles the directories in the state area also.

In addition the general commercial superintendent has a commercial engineer. His duties are in connection with the predictions as to population. In different areas we require this in order to know how much switchboard to provide. We have to guess or estimate in advance all the time so as to be ready for the demand; we estimate as to, in a given area, how many people there will be. That may involve the establishment of a new central office building in that area, may
2754 involve additional switchboards; it may involve additional trunk lines. He is charged with responsibility of making those estimates as to population growth and the shifting of population in the different areas. In addition, he deals with the subject of rates for telephone service—all the rate work is centered in the commercial engineer: The preparation of and filing of rates and tariffs with the Illinois Commerce Commission, everything of that sort.

Then he has one other general employe, a general commercial supervisor, and here again we find the staff functioning with the commercial department, which I have spoken of. His duty is to study the work and problems of the commercial department, as to its adequacy, as to how it can be improved, as to how the cost can be reduced, as to the satisfaction of the public, what a customer is getting from it, and all that

sort of thing. He is the staff employe charged with studying these things, all the activities of the commercial department.

I have a similar organization for the state area. There
2755 may be one or two more employes in common between the two areas besides the directory superintendent. They may not be shown on this chart, because this chart does not go down into the finer details. There are some other employes. There are relatively a few other employes.

The situation in 1923 is shown on the other chart (Plaintiff's Exhibit 74). At that time I was vice-president and general manager and had no general managers under me. The substantial difference between the two charts is the introduction of two general managers; the division of the entire territory of the Company into two areas, and the introduction of a general manager for each area.

The division into two areas was made because the proposition was getting pretty large. We thought we would get better results with a closer supervision. What we particularly wanted was a closer company over-all picture, closer down to the subscriber. The amount of detail became
2756 so great with the growth in the company we felt that it was a highly desirable move and would result in better service.

I first came to Chicago in 1921. At that time Mr. Abbott was general manager and Mr. Sunny was president. I first came here as chief engineer. I became general manager in 1922, I think in February. I suspect that is in the record here somewhere. When I first started in the telephone business I was not connected with the A. T. & T. I was at one time connected with the A. T. & T. That was for a
2757 period of three years between 1909 and 1912. I was then on what is known as the general staff. I was an engineer. My functions had to do with traffic problems and the quality of service, traffic costs, and so forth.

2758 I am familiar in a general way with the character of the work performed by the general staff of the American Telephone & Telegraph Company under the license con-

tract. More particularly I am familiar with the work in connection with operation and engineering rather than the development and research, for instance.

2759 From the standpoint of an associated company, the work of the general staff is a work that you would expect to find performed by the office of consulting engineers, for instance, or consultants. They are not engaged in the day to day routine operations involved in furnishing telephone service for a given section of the city, or a given city, or a given state; and that is the function of the associated company. They are engaged in keeping themselves informed as to the progress in the art, as to new operating methods; they are engaged in studying, in a general way and as a staff activity, how the service can be further developed, improved, and cheapened.

The character of the equipment used throughout the Bell System is standardized. By standardized I mean for a
2760 given purpose at a given time the same type of equipment is used. As developments occur either in the design of that equipment or development in the telephone service, that equipment may change, it may take a different design, maybe a different style of equipment, but that new design is arranged to work with the old equipment and can be added to the old equipment in nearly every instance. All that is taken into consideration, and I think that gives a general idea of what I mean by standardized equipment. It does not mean that there is no progress; it does not mean that the development of apparatus is frozen or anything of the sort. It does mean that when you get a development that that development and that design is going to be studied with relation to what is already there and what it has got to work with, and it will be changed to work with it, so that you will get progress as you go along.

I, and the men under me, receive advice and assist-
2761 ance from the general staff and consult them. I don't remember exactly how long I have been a director of the Company. I would say, perhaps 1925, 1926 and 1927; perhaps three years. Mr. Gifford, President of the American

Telephone & Telegraph, is a director of the Illinois Bell. During the time I have been a director, I have attended all but three or four meetings and I have never seen him at a meeting. Mr. Cooper, the Executive Vice-President of the American Telephone & Telegraph is a director of our company. He attends an average of three directors' meetings a year. He makes no pretense of attending every meeting.

During my telephone experience, both as a member
2762 of the general staff for three years and in my operating experience in Missouri, and particularly in connection with my operations in Chicago as chief engineer, general manager, and executive vice president, I do not know of any instance where the American Telephone & Telegraph Company, through its officers or its general staff, have attempted to do anything more than advise and assist the operating companies.

(It is stipulated that the license contract between the American Telephone & Telegraph Company and the Illinois Bell is pledged as security under the first and refunding mortgage of the Illinois Bell, dated June 1, 1923, securing the original issue of $50,000,000.00 worth of bonds, and that pledge was made by and with the written consent of the American Telephone & Telegraph Company to the First Trust

& Savings Bank, Trustee under that mortgage in the
2763 form of a letter marked for identification as Plaintiff's Exhibit 75. That on page 9 of the trust deed in question which describes the property securing the mortgage the first full paragraph on that page reads in part as follows:

"And also all patents, patent rights, licenses, license agreements, including any and all license agreements with the American Telephone & Telegraph Company, and other rights, privileges, contracts and agreements and any and all interests therein appertaining thereto or useful in the transaction of its business in the state of Illinois." (Plaintiff's Exhibit 75 admitted.)

If the company should default in its bonds and its property be sold under foreclosure under the usual form of decree

whereby the purchaser has the option to accept or reject all contracts and I were to decide or take the responsi-
2764 bility of deciding as an officer of the company that took the title in the foreclosure sale, whether to enter into the license contract or not in its present form, I should renew it as soon as I could because I think it is very advantageous to the local company. I think it is advantageous to the subscribers. I don't know just what the situation would be in regard to apparatus covered by patents, but the development work and the work as to the future that is being done by the American Telephone & Telegraph Company, there would be no question in my mind as to the value to the reorganized company in renewing that contract to get the advantage of that work, based on what we know as to what they have done in the past.

I know of an instance where a telephone company has been foreclosed on and the property bought in at foreclosure sale by persons having no connection with the Bell System and the license contract has been entered into after the foreclosure sale. I think that occurred in 1903 or 1904, in
2765 Michigan when the N. W. Harris Company purchased the telephone company then operating in Michigan.

Plaintiff's Exhibit 76, being letter dated January 11, 1911, from N. W. Harris to Mr. Sunny offered in evidence.

2770 Objection sustained.

2771 *Cross-Examination by Mr. Goldstein.*

I can't state positively but I am practically certain that the Illinois Bell has never had to directly secure any money for the employees benefit plan under the provision of the 4½ per cent license contract covering obtaining funds from the American Telephone & Telegraph Company to replenish any deficits in the benefit fund.

I was in St. Louis with the Southwestern Bell Telephone Company System from 1912 until I believe April, 1921, when I came up here. I never worked for the Central Union Telephone Company.

I think I would say that the members of the Bell System as it stands today is the result of organization and system in which every individual member is a free, active and responsible agent within his own sphere of action and the limitations of his duties. I think there are varying degrees of responsibility. I would feel a greater degree of responsibility to the Illinois Bell than I would to the System. The Bell System is the organization of which the Illinois Bell is a part. My conception of the Bell System is the Illinois Bell plus the Associated Companies, plus the American Telephone and Telegraph Company. I consider the American Telephone and Telegraph Company, the Associated Companies and the Western Electric Company constitute the Bell System. Of course, there are numerous subdivisions but the system is in general the companies owned by the American Telephone and Telegraph Company. The 4½ per cent contract in my opinion relieves the Illinois Bell Telephone Company of maintaining anything but an operating organization. It makes it unnecessary to do more than that. It has, in fact, during my experience in the Illinois Bell relieved the Illinois Bell from the obligation of maintaining any organization other than an operating organization.

I am not bound as far as the Illinois Bell is concerned by the decisions of the general staff. I may make decisions which affect the balance of the Bell System without getting the approval of the general staff. It is pretty nearly impossible to decide anything that in due time will not affect other telephone companies. I don't spend all my time on the telephone asking New York what it thinks about this thing, that thing, or the other thing. I doubt very much if I would want to make a decision as Acting Manager of the Illinois Bell on a question which was not a local question but a question of policy involving the whole Bell System, without discussing it and getting the consent of the American Telephone & Telegraph Company. I am paying for con-

sulting services and I would go there to get that. If
2783 I got those consulting services I would then feel free or as a part of my duties that I could make a final decision even though it were to disregard that advice. I would feel perfectly free to do it. It is my conception of my duty to look out for the interests of the Illinois Bell Telephone Company. If in the last analysis that was the way the decision ought to be made, it is my conception that it is the policy of the Illinois Bell in its relation to the balance of the Bell System, that it can make final decision on all matters even though they affect the balance of the system, without the consent of the general staff. There are
2784 questions of degree of effect that come in there. I still feel that no matter how much it might affect the balance of the system I could decide it without the consent of the American Telephone & Telegraph Company. I probably wouldn't do it without their advice. I certainly could overrule their advice if I saw fit. I might lose my job a couple of years later but I could overrule it just the same. I might be acting at my peril. If I were relieved of further responsibility, I believe the Board of Directors would do that.

2785 I was Chief Engineer of the Illinois Bell from April, 1921, I think, to February, 1922. Then I was Vice-President and General Manager until 1928, and then Vice President.

2786 The document I have just been handed appears to be, and I would say it is a copy of the 1925 Chicago Directory. On the front cover is a bell and a ring entitled "Illinois Bell Telephone Company, American Telephone and Telegraph Company." We have used that seal at various times. I don't know whether it has been changed since 1925 or not. It was being used at that time.

2787 Pages 12 and 13 in this directory were prepared under my supervision. That is, I didn't personally supervise the preparation, they were prepared by the Illinois Bell. Pages 1319 and 1320 were inserted with our concurrence, and I think this advertisement on page 1319 was prepared by the Illinois Bell. Page 1320 was certainly inserted

here with our concurrence. I can't say positively where the subject matter—I mean it was made part of the directory with our concurrence. I don't offhand, know who paid for
the insertion of pages 1319 and 1320. I can only judge
2788 from the subject matter whether the American Telephone & Telegraph Company stood any part of the expenses of the publication of this. I can't answer your question positively yes or no. I can give you my opinion. This is the ad of the Illinois Bell Telephone Company and I think
was paid for by the Illinois Bell.

2790 I have the number of employees as of December 31, of each year, 1915 to 1925 inclusive. I haven't the number of shares of American Telephone & Telegraph stock that they own. I have some information here and the number of shares of the A. T. & T. stock which were under subscription at the end of the year. You understand the plan provides for monthly deductions from the employees' pay and I have information as to the number of shares under subscription
at the end of each of those years.

2791 *Re-direct Examination by Mr. Bangs.*

If I exercised bad judgment in conducting the affairs of the Illinois Bell I would expect to be discharged. I would not expect to be discharged simply because I had not conformed to a standard practice of the Bell System; not if I
used good judgment in not conforming to it.

2541 EDWARD V. COX, called as a witness on behalf of the plaintiff in rebuttal, being first duly sworn, testified.

Direct Examination by Mr. Bangs.

My name is Edward V. Cox. I reside at Plainfield, New Jersey. I am employed as Assistant Vice President by the A. T. & T. Co. at New York. I was educated as an engineer graduating at Yale University in the year 1894 in the mechanical engineering course with the degree of Bachelor of Philosophy. I then entered Columbia University and graduated in 1895 with the degree of electrical engineer. On

graduating from Columbia, I entered the employ of the A. T. & T. Co. in the long lines department and for the four years from 1895 to 1899 I was employed as inspector
2542 and assistant wire chief and general inspector on all kinds of inspection and maintenance of central office and sub-station equipment and on installation and maintenance of toll lines and maintenance of submarine cable.

For the next eight years, that is 1899 to 1907 I was in the engineering department employed as engineer on various kinds of engineering studies such as the design of equipment and supplies, standardization of those items. I had charge of the repair shop for some years and I handled all of the repairs on supplies and equipment returned from the field, rehabilitating equipment that was repairable and disposing of what was not repairable. I also had charge in that time of all of the design for underground conduit that was built by the company and I had actual charge in the field of this same conduit which included upwards of 125 miles of trench. From 1907 to 1911 I was employed as assistant to the general superintendent of plant, having charge of matters of organization and management, that is, the non-technical side of his work.

2543 In 1911 I entered the general department of the A. T. & T. Co. and became chief accountant. In the accounting department from 1911 to 1917, I had charge, as chief accountant, of the development of the accounting system, the development also of the routines and procedures by which that accounting system could be most economically and efficiently followed. This period coincided with the period in which the Interstate Commerce Commission promulgated its standard accounting for telephone systems. I cooperated in the negotiations with the Interstate Commerce Commission and when its system was promulgated, I arranged for the adaption of the telephone accounts to the Interstate Commerce Commission accounts. During this same period I was chairman of a joint committee representing the Bell telephone interests and the independent telephone interests on accounting matters so that as far as possible the recommendations

made to the Interstate Commerce Commission would be in agreement.

In 1917 I became general auditor and until 1919 had charge of the general books of the company and the payrolls and authorizations.

2544 In 1919 I became supply contract auditor having to do with the supply service of the Bell System Companies.

In 1922 I became Assistant Vice President having duties similar to those of the preceding position, that is to say, dealing with the supply services and also other duties as assigned. I still hold the position today and the duties remain the same.

My work has required me to be familiar with the relations between the A. T. & T. Co., the Western Electric Co., and the Illinois Bell Telephone Co., and other associated companies. I have been closely in touch with them since 1911. My duties in connection with that matter as supply contract auditor and Assistant Vice President relate particularly to the supply contract, which is a uniform contract between the Western Electric Company and the associated companies and also the A. T. & T. Co. itself. It is my duty to be familiar with the working out of that contract, that its provisions

2545 were fair, that the associated companies received, under the contract, the services they were entitled to receive and that the charges were proper and equitable. It is also my business to in every way possible make recommendations that would tend to render the contract more efficient, and the services better or less expensive. My duties were fastened on me by my superior who was originally the comptroller of the company and then later by the Vice President. I was transferred from the department of the comptroller to the department of Vice President. I have my instructions directly from him orally.

2546 During the entire period of nearly 35 years, I have been with the American Company. First of all my department must be familiar with the workings out of the supply contract. I keep in touch with the actual conditions that

exist in the field. I must know how the supplies are obtained, the process by which they are sold to the associated companies. I keep in touch with the prices that are charged, not only by the Western Electric Company for these goods, but the prices that are charged by other concerns who also furnish goods either exactly alike or similar thereto.

2547 Under the standard supply contract of 1924 the Western Electric Company agrees to sell supplies of its own manufacture to the Telephone Company at prices as favorable as to its most favored customer. It undertakes to maintain store houses particularly for the service of that company and to maintain therein adequate stocks. It agrees to supply materials not of its own manufacture, which the telephone company may desire the Western Electric Company to purchase, and to pay for the goods, inspect them, carry the charges until billed and finally ship the goods on order of the telephone company, charging therefor the net cost to the Western Electric Company, plus remuneration, which is stated in the contract. The remuneration depends on whether the goods are shipped direct by the supplier to the telephone company or whether they are shipped to the Western Elec-

2548 tric Company as intermediary and held in their warehouse before shipment. Direct shipments are charged at present at 3½ per cent of the net cost of them to the Western Electric Company and warehouse shipments are charged at 10 per cent. I will have to refer to my figures to give you exact charges that were in effect on that contract, January 1st, 1924.

The Illinois Bell does not have any purchasing agent or purchase department at all. The Western Electric Company is the organization that handles that.

The 3½ per cent refers to merchandise that the Western Electric buys as jobber from other people and isn't the way the compensation is figured where the Western Electric

2549 manufactures. Manufacturing is an entirely different proposition:

The contract in effect on January 1st, 1924 had this provision for the remuneration. There were two classes depend-

ing, as I have already indicated, on whether the goods were carried in stock by the Western Electric Company or whether it shipped direct. If the commodity was hard drawn copper wire and ties therefor, the charge was 1½ per cent shipped direct, 5 per cent shipped from stock. The charge for poles was 4 per cent shipped direct. They were not carried in stock, therefore no charge for that. Stationery and office supplies, 5 per cent shipped direct, 10 per cent shipped from stock. Stationery and office supplies where simplified billing is not in effect, 5 per cent for shipments direct, 12 per cent from stock. Directories when shipped direct, 1 per cent, no provision for stock. Other supplies 4 per cent shipped direct, 8 per cent shipped from stock.

2550 The Western Electric Company also offers to conduct a number of optional special services. Those are as follows: Receiving, classifying, storing, insuring, carrying investment in or disposing of apparatus and supplies returned by the telephone companies; carrying special or unusual stocks; making repairs to apparatus or supplies that have been returned; making technical engineering inspections. There are quite a number of those, and as a matter of fact the Illinois Company and all of the associated companies have exercised their option and asked for these services and in each case the service is then covered by a supplemental contract outlining the particular arrangement under which this service will be given. There is quite a list of those and I shall not go into all that detail.

2551 All the goods that have been shipped in any one month are billed at the end of that month and payment from the telephone company is due at the end of the succeeding month; in other words, the Western Electric Company carries the investment on the average 45 days after shipment.

The Western Electric Company makes special technial inspections so that the goods shipped are known to be in accordance with the specifications approved by the A. T. & T. Co. There are specifications for the different kinds of wood and the different sizes of poles both as to height and as

to the load that they are intended to carry. The Western Electric Company does all that inspection for the Illinois Bell.

2552 The arrangement with reference to the goods that the Western Electric manufactures and sells to the plaintiff, is as stated in the contract, that the price charged shall be no higher than that to the most favored customer. As a matter of fact, other customers are charged higher than the prices to the associated companies. The requirement is that they shall get the best price under any conditions.

Of items which the Western Electric Company manufactures itself, they sold in the year 1928, $179,000,000 to the associated companies, including the A. T. & T. Co. itself, and to all others, $20,000,000. The percentage has varied from time to time.

2553 In the last five or six years it will run approximately 90 per cent to the Bell System. I don't recall that I testified before that in 1923 the percentage was 84 per cent and 16 per cent.

The Western Electric Company sells a very limited amount of merchandise that it does not manufacture, to companies other than the Associated Companies. The arrangement has been handled in this way; I will have to give a historical picture in order that it may be clear.

Going back about ten years, the Western Electric Company then was selling not only to the Bell Telephone Companies but to the other consumers which we were accustomed to designate as the general trade. It had for the purpose two distinct departments, known as the Telephone Department
2554 dealing with the Bell System and Supply Department dealing with the general trade, and that Supply Department was physically separated from the Telephone Department. Ultimately it was found desirable to organize a separate company to handle that work. That company was a wholly-owned subsidiary of the Western Electric Company and was called the Graybar Electric Company, Incorporated. The Graybar Company sold articles of general merchandise,

mostly electrical. The sales of that company last year were approximately $73,000,000, and of that about 13% represented manufactures of the Western Electric Company. At the close of last year the Graybar Company was sold to an organization composed exclusively of employees of the Graybar Company. Now it is no longer controlled by the Western Electric Company.

2555 (Plaintiff's Exhibits up to and including 63 that have not already been offered, admitted in evidence, except those specifically ruled out, if any.)

(Plaintiff's Exhibit 64 marked for identification.)

The chart (Plaintiff's Exhibit 64) first of all divides the relationships between the Western Electric Company and the various organizations shown on the chart into two main groups, namely the Bell System business and the general trade. Now, in connecting the block representing the Western Electric Company with the other blocks representing other concerns, there are lines which, when solid, represent merchandise. Where the lines are dotted, it simply means information.

2556 Now, considering the upper half of the diagram, that is, relating to the Bell business, we have the Western Electric Company dealing direct with the Associated Bell Companies, and I have included there the American Telephone & Telegraph Company itself. In that group the Western Electric Company furnishes merchandise of its own manufacture, here designated "W. E. Mdse." The sales last year of that classification amounted to $179,000,000. Goods which were not manufactured by the Western Electric Company but obtained from miscellaneous suppliers, which are indicated at the left hand margin, were sold by the Western Electric Company to the Associated Companies in the amount of $88,000,000. I spoke of that as a selling. Of course, it technically is a purchasing agent arrangement, but the transaction between them takes the form of sales and is so recorded.

You will also note the dotted lines that show the general relationship between this group of companies. We have the

Associated Bell Companies dealing directly with the
2557 operating and engineering departments of the American Telephone & Telegraph Company. Information and advice is furnished and the needs of the associated company are determined.

Then the adjacent department indicated in the American Telephone & Telegraph Company's block, namely the Development & Research Department, cooperates with the Operating & Engineering Department in working up such development and research as is necessary to meet the needs of the system. That work is handled by the Development & Research Department with the Bell Telephone Laboratories. Then in turn the Bell Telephone Laboratories has directed relationship with the Western Electric Company in the detailed design of such apparatus as ultimately is manufactured under the specifications developed by the Research Department.

In furnishing the supplies to the Associated Companies, the Western Electric Company has 33 distributing houses, which are located at strategic points in the territory of each associated company, and at the end of last year, that is, December 31, it carried $31,000,000 in merchandise available for immediate shipment.

2558 Taking the portion of the chart dealing with the general trade, the Western Electric Company in disposing of its manufacture to the general trade deals through distributor companies and those distributor companies are in two classes. We have, first of all, a group of companies handling telephone and telegraph apparatus. Those companies are the Graybar Electric Company, which I have already mentioned, the Northern Electric Company of Montreal, which deals with Canada and Newfoundland, and the International Standard Electric Corporation, which is the distributor for the balance of export. The Northern Electric Company is a manufacturing and distributing concern paralleling the functions of the Western Electric Company in the United States. The International Standard Electric Corporation is the Manufacturing Department of the International Telephone & Telegraph Com-

pany. It has factories in ten countries of Europe and the Orient, and last year had sales of $49,000,000.

2559 The Bell System has an interest in the International Standard Electric Corporation in just this way. There is no financial interest whatsoever, but all patents which are developed by the International Standard Electric Corporation, so far as American rights are concerned, are available to the Western Electric Company, so that the widespread and very large business represented throughout the world all tends to feed in to the benefit of the Bell System.

The second group of distributors is represented by the Electric Research Products, Inc. That is a wholly-owned subsidiary of the Western Electric Company which was established to handle those kinds of by-products which were not suitable for distributing through an electrical supply house such as the Graybar Company. This research company handles, as shown here, such items as permalloy, which has already been referred to in the testimony today, also orthophonic devices as exemplified by the Victor Talking Machine and the improved records that are used with it; the talking motion pictures, of which the Vitaphone and Movietone are trade

2560 names of apparatus manufactured by the Western Electric Company. Now that group is handled by a single company, both domestic and export.

In dealing with these distributor companies, the arrangement is that the price to them shall never be lower than it is to the Associated Companies. As a matter of fact, it averages about 5 per cent higher. This chart also shows at the foot of the page the incorporate relationships, based on voting stock.

The block shown on this chart as the International Electric Corporation was originally the International Western Electric Company, representing a wholly-owned subsidiary established by the Western Electric Company to handle the export business and ultimately sold in 1925 to the International Telephone & Telegraph Company.

In connection with my duties I have to study the compet-
2561 itive market. I ascertain what prices are charged by concerns which offer apparatus and supplies similar to those sold by the Western Electric Company. I ascertain those prices for telephone apparatus, lead-covered cable; that is to say, items manufactured by the Western Electric Company itself.

The Western Electric Company manufactures nothing that does not deal with communication apparatus, used in a broad sense. These talking movies are to that extent communication apparatus, but it is telephone and telegraph apparatus and cable and the by-prodcts that relate directly to that service.

In checking the prices of other concerns for items of that kind, I obtained directly from these concerns their price lists and discount sheets. It happens that in the Bell System there is a great deal of apparatus that has been manufactured by these concerns, that has been bought by the Bell System in con-
nection with the consolidation of independent properties
2562 and Bell System properties, and that apparatus must be maintained as long as it is serviceable. That at times must be expanded, so these prices are actually used by the Bell System Companies and come to me as a matter of routine. I also have an opportunity of checking those prices in a further fashion, because when companies have become merged with the Bell System I have had an opportunity of reviewing their purchase records during their period of independence, and have gone back and compared the actual prices that were charged those companies by independent telephone manufacturers with the price records that we had as in effect on the corresponding dates, and I have found that the price lists and discount sheets furnished us have been substantiated by prices actually charged.

In making my comparisons I always do this: I take the list prices shown in the price list and then I take the maximum discount for quantity or cash, or any other discounts that are indicated, so that the price I use is the lowest price regard-

less of the particular quantity or the arrangements under which the purchase was made.

2563 There are, of course, cases where items are sold that are not shown in the price list. Such cases are assemblies, as a completed switchboard sold installed for a lump sum. There isn't any way of breaking that down into its elements and setting up a Western Electric price exactly like it, without having complete traffic data and all the other engineering data necessary to lay out the telephone central office.

In the case of supplies not manufactured by the Western Electric Company, we have as an immediate check the fact that the Graybar Company is selling to the general trade items that correspond with those that the Western Electric Company sells to the Associated Companies, so that I am able to ascertain the prices that are actually charged and result in large sales by the Graybar Company, in competition with the prices charged by the other manufacturers.

I am constantly making studies of comparison of the
2564 prices. I have in front of me a study covering prices taken every six months from the date, January 1, 1923, to January 1, 1929. This study covered items selected as follows: I took the manufacturing output records of the Western Electric Company and determined the most important classes of apparatus and the most important items in those classes. Then I endeavored through our Engineering Department to ascertain what items could be obtained from other concerns comparable with the items that I found to be representative of the Western Electric Company's output. These items were found to the extent of 102 items, which continued over this period of six years. I then priced those items for each date, taken every six months over the period at the prices charged by the Western Electric Company to the Associated Companies, and I extended those prices at the output of the Western Electric Company, representing the average for the years 1925, 1926 and 1927. That gave me the price which the

Associated Companies would have had to pay for these articles for each pricing date over this period of years.

2565 I then ascertained the articles which the Graybar Company would have sold corresponding to these items and priced them up, the identical quantities being used for the comparable items. I did the same for the principal competitors of the Graybar Company in the general trade, namely, the Kellogg Switchboard & Supply Company of Chicago, Illinois, and the Stromberg-Carlson Telephone Manufacturing Company of Rochester, New York. I obtained for the corresponding dates what this fixed bill of goods would have cost if purchased from these other two concerns, and then I compared the totals for the corresponding dates of all these prices, and I found that the price to the Associated Companies was invariably lower, and that the lowest price of any of the competitors, that is, the Graybar Company sold to the general trade, or the Kellogg Company or the Stromberg Company, was 26% higher. The prices in general have been substantially higher than that. That is the lowest differential that existed at any time during the period of these six years.

2566 (Plaintiff's Exhibit 65 marked for identification.)

2567 Plaintiff's Exhibit 65 is a study I referred to in my testimony, and the conclusion I have drawn as to the lowest competing price is shown in this exhibit.

(Plaintiff's Exhibit 66 marked for identification.)

Plaintiff's Exhibit 66 shows the actual sales of the Western Electric Company apparatus in the general trade, as made in the years 1916 to 1928 by the Graybar Company, Incorporated, or by the Western Electric Company itself, prior to the incorporation of the Graybar Company. The lower part of the form shows the years, and opposite the year in Column B, is shown the actual Graybar sales that were made to the general trade.

Column C in each case shows what the identical sales would have cost an associated company. In the next column

2568 D it shows the difference between the amount of the actual sales and the amount which the associated com-

pany would have had to pay for these sales. In every case this is in favor of the Associated Company price, and the whole period is summed up at the foot of the table.

In other words, over these years, 1916 to 1928, there was sold a total of $67,114,000, and these identical items if sold to the Associated Companies or the Illinois Bell Telephone Company, would have cost $49,480,000, showing that there was a saving on the basis of the contract with the Illinois Bell Company or any other associated company, of $17,634,000, or 36%. This is somewhat less than the 10 per cent of products manufactured by the Western Electric Company that were sold outside of the Bell System, because it deals only with domestic general trade.

(Plaintiff's Exhibit 67 marked for identification.)

2569 I should have explained in connection with Exhibit 66 that the graph at the top of the form just plots these sales prices.

Plaintiff's Exhibit 67 is prepared exactly following the arrangement of Exhibit 66, but it deals with lead-covered cable as manufactured by the Western Electric Company, instead of telephone apparatus, and shows the sales made to the general trade during the years 1916 to 1928 by the Graybar Electric Company, Incorporated, or by the Western Electric Company prior to the incorporation of the Graybar Company.

Just taking the summary we have then in this entire period the total actual Graybar sales to the general trade, amounting to $25,131,000. These actual sales on the basis of the supply contract with the Associated Companies would have been priced at $20,707,000, showing a saving on the contract basis with the Associated Companies of $4,424,000 or 21 per

2570 cent. That volume of sales to the outside trade is very small as compared with the sale of lead-covered cable to the Associated Companies. I made a study for the year 1921 as to the purchases of the Illinois Bell Telephone Company and put that study in before the Illinois Commerce Commission. I have a copy of that study.

(Study marked for identification as Plaintiff's Exhibit 68.)

I think Mr. Goldstein is mistaken when he says I made a study for the year 1920 for the Illinois Commerce Commission. With reference to Exhibit 68—all the purchases
2571 made by the Illinois Bell Telephone Company from the Western Electric Company in the year 1921 for manual telephone apparatus and lead-covered cable were recorded, and as far as possible, items manufactured by other concerns that were comparable thereto were determined. The first page of this exhibit gives a complete outline of the exhibit, but I will explain it from the second page of the exhibit.

In this table it appears there are two classes of commodities; telephone apparatus and lead-covered cable. Considering telephone apparatus, we take items that are found to be comparable. The items of this nature were found to represent 46 per cent of the entire volume of sales. The actual price paid the Western Electric Company for these items was $2,908,090. The lowest price at which similar items could have been obtained from competing manufacturers is shown here as $3,074,570, showing a saving of $166,480, or 5.72 per cent, in favor of the Associated Companies' price.

I will have to explain that this is a very drastic comparison and that this price of 5.72 is very much too low.
2572 The way that happened is this: In drawing off these items a mistake was made of not recording the date of sale, so I was faced with the need of assigning some corresponding price by the competing company. Not having any date, and inasmuch as the prices of competing companies shifted during the year, the arrangement that seemed most fair to me was to take the lowest price that had been in existence by any of these companies at any time during the year. That process resulted in this differential of 5.72 per cent.

That was not an intentional method of making it. It was a pure mistake that wasn't ascertained until this immense volume of detail had been finished and the matter transferred to New York for pricing, at which time this defect was noted and we were faced with the difficulty. However, it was possible to make without undue expense an estimate of the effect

of this pricing. That was done by taking all items which amounted to $10,000 or over. Items purchased in that
2573 volume represented 60 per cent of all the items compared, and indicated that if the pricing had been exactly in accordance with the prices ruling as of a given date of sale, the differential instead of being 5.72 would have been about twice that much.

The unfairness of the arrangement originally handled is shown by a typical example. For instance: The Kellogg Desk Stand No. 118 was compared with the Standard Western Electric desk stand No. 20 A. L. The Kellogg price during the year ranged from $3.80 to $4.90 and the price of $3.80 was in effect only eight days, but that was the price we used in the study. When those prices were properly weighted up by the number of days in effect, it showed that these percentages should have been just about double.

Now there were a number of items that could not be compared that represented 48% of the total study. The classification of those items is indicated at the foot of page 2. Obviously, there would be no method of equating to installation or engineering or drafting or other non-quoted items. In that case, in order to be more than fair I assumed that the
2574 price of the competing manufacturer would be as low as the Western Electric Company's price. I did that in spite of the fact that there was shown to be a substantial differential in favor of the Western Electric Company's price on the items which could be compared.

Two other items affect the price of telephone apparatus. Freight is not charged on apparatus furnished by the Western Electric Company, but freight is charged by the other concerns which competed. The estimated freight was found to be $267.00, so that was added to the lowest competing price of these other concerns, also $237,373 was added to cover purchasing and similar expense, making a total Western Electric price of items comparable and non-comparable of $5,934,-313, which compares with the lowest estimated price of competing manufacturers of $6,338,433 or 6.81 per cent in favor of the Western Electric price.

46 per cent of the total purchases represented telephone apparatus which could be compared. We were able to compare
all of the lead-covered cable, which represented 6 per
2575 cent of the total. The differential in the case of lead-covered cable in favor of the Associated Companies' price was found to be 25.09 per cent. Taking the entire study, the purchases actually made total $6,304,596. The lowest price at which competing articles could have been obtained was found to be $6,801,619, which is $497,023 or 7.88 per cent higher than the Western Electric price and, as before stated, that 7.88 is much too low.

I have been able to check the actual prices paid by independent companies for apparatus similar to that used by the Bell Companies. Where an independent company has been absorbed by the Bell System Company, the purchasing records have come into the possession of the Bell Company and I have been enabled to review those records and see their actual paid invoices. Sometimes I have seen actual checks that paid the invoices and I therefore have been able to make a comparison
of the prices actually paid with the prices that were
2576 shown to be effective by the price books and discount sheets which we had at that time. I also have had further opportunity of making comparisons of this kind because a certain independent company has recently become a sub-licensee of one of our Bell System Companies, and one of the elements in influencing that company to become a sub-licensee was a study that I made of its purchases. It was a very large company. I have an exhibit here showing the result of my study of the prices of independent companies.

(Plaintiff's Exhibit 69 marked for identification.)

2577 The Tri-State Telephone & Telegraph Company of St. Paul, Minnesota, is an independent telephone company operating in a large part of the State of Minnesota. Page 2 of this exhibit (Plaintiff's Exhibit 69) shows a brief history and general description of this particular company. I just call attention to its size. Its assets at the time of the

study amounted to over 21 million dollars, its annual
2578 revenues to over $5,400,000, and its stations exceeded 103,000 in number.

This company connects with the Bell System but the Bell system has no financial interest in it, has no ownership of stocks or bonds or notes or anything of that nature. It is, however, a sub-licensee of the Northwestern Bell Telephone Company. By sub-licensee I mean that the Northwestern Bell Telephone Company, with the consent of the American Company, has a contract with the Tri-State Telephone & Telegraph Company by which the Tri-State gets the benefits of the license services of the American Telephone Company to the Northwestern Bell Telephone Company. The Tri-State pays the Northwestern 1½% on gross revenue, figured identically as the 1½% paid by the Northwestern to the A. T. & T. Company.

A study was made for the purchases in the year 1926, that is, prior to the time at which this sub-license arrangement was effected. The study includes all the central office and sub-station equipment, lead covered paper insulated cable and outside plant supplies purchased by the Tri-State Telephone & Telegraph Company in the year 1926.

2579 Total purchases studied amounted to $613,749. To this showing the actual payments were added for freight paid amounting to $2,145 and a sum of $20,000, representing the estimated excess which the Tri-State Company incurs by reason of the fact that it has to maintain its own purchasing organization and store rooms, which it would not have to maintain if it had the benefits of this supply contract.

Turning now to page 3 of the exhibit, this shows a tabulation of the results of the study. The classification is "Central Office and Sub-Station Equipment." Again we have the condition of items comparable and items which could not be compared, and the same treatment is given the items that could not be compared as was given in the case of the Illinois study. That is to say, if an item is known not to be comparable, it was assumed that no matter from whom purchased, the price would have been the same as the actual price paid; that is, I assumed no saving at all on non-comparable items.

Now on that basis, the total cost of central office and substation equipment was $150,392; that is, that was the actual cost paid. The Western Electric Company would have furnished that same equipment for $130,985, which is $19,407 less than the amount actually paid. The actual price
2580 was 15% higher than the price of the Western Electric Company.

In every case I have included in this study with the purchase price the freight that was paid. The freights were associated in the records of the Tri-State Company with the purchases and I made that association in the price here.

Lead-covered cable was purchased to the amount of $254,600. The Western Electric Company would have furnished equivalent cable for $208,108. The actual price was $46,492 more than the Western Electric price, or 22%.

Outside plant supplies were purchased to the amount of $210,902. That was $20,758 more than the Western Electric would have charged, or 11%.

Adding in the item of supply expense heretofore alluded to, it makes a total cost to the Tri-State Company in that year of $635,894, against which the Western Electric Company would have charged $529,237, showing an excess of actual price over Western Electric Company cost of $106,657, or 20%.

2581 I submitted this study to the President of the Tri-State Company in accordance with an arrangement made with him. About a year subsequent to that they entered into the sub-license contract. I have made quite a number of similar comparisons of the purchases of other independent telephone companies.

(Plaintiff's Exhibit 70 marked for identification.)

Plaintiff's Exhibit 70 shows the result of those studies in summary form. They were made in substantially the same way as the study made of the Tri-State Company. There are differences in procedure over the period but the results are comparable.

I keep in touch with the costs of the work of the Western Electric Company for purchases of general supplies for the associated companies.

2582 Originally the supply contract was entered into on the basis of cost to the Western Electric Company, plus a reasonable return on the investment necessary to conduct the activity. That principle has been followed ever since, though the present form of the contract does not bring out the fact.

The rate of return which has been figured throughout all this period has been 6%. I might say that all of the changes which have been made in the contract in the way of remuneration rates have been made in accordance with that principle. That is to say, as conditions were found changed and the rates became inequitable they have been adjusted, and in that way the changes all equate down to this time to get 6% as the remuneration on the investment. As a matter of fact it has run very much less than 6%, but that has been the aim.

I can estimate for the year 1928 from the studies I have made, the amount of savings that the Illinois Bell Telephone Company is making under this contract. In my opinion

2583 the Illinois Bell Telephone Company saves at least 16% on the total purchases made through the Western Electric Company. In 1928 those total purchases were approximately 20 million dollars. My opinion is that the amount of those purchases going into construction would exceed 90%. They might exceed it quite a little.

I can segregate the gross saving of 16% into the savings on apparatus, lead-covered cable, and telephone supplies. I went through that process to get the 16%. The purchases of apparatus in 1928 amounted to approximately 12 million dollars, and I estimate the savings on that class would amount to 19%. On lead-covered cable the purchases were in excess of $2,200,000. I estimate a saving of 19% on that class. The purchases of supplies exceeded $5,600,000. I estimated 10% saving on that classification, making a total saving for the three classes of $3,297,000.

2584 My opinion is based upon the studies I have described and other studies I make in connection with my depart-

ment. These studies are constantly being made.

I think it would be helpful to touch on the organization through which the Western Electric Company furnishes these services. I have already mentioned that they have distributing houses. There are 33 of these distributing houses and the one for the Illinois Bell Telephone Company is located here in Chicago. There are other distributing houses nearby; for example, at Milwaukee, at Omaha, at Des Moines, at Cincinnati, at Indianapolis, and so on.

The Western Electric Company is a national organiza-
2585 tion giving a national service and it arranges its entire program so as to furnish this service at the minimum cost. In other words, it is possible for it to arrange its stocks so that the stock carried in any distributing house is no more than adequate to handle the needs of that territory. Where additional demands arise they can be met by calling on other distributing houses not normally serving that territory. They can still further be met by diverting shipments which were intended for maintaining stocks at those distributing houses to the particular point where the emergency exists. In that way there can be a stream of supplies pulled in at any moment, which far exceeds the possibilities that would exist in any other organization in this country.

Coming to the sleet storm which occurred on December 18 and 19, 1924, which was the most severe sleet storm in the experience of the Bell System—by severe I mean in point of damage caused—it commenced in Missouri and proceeded in a generally northeasterly direction, crossing through the center of the State of Illinois. It was a very severe storm. Ice formed to two inches in diameter and over all the wires, and co-incidently with high winds and followed by very severe weather with the thermometer down as low as 16 de-
2586 grees below zero. The damage was as follows: There were 65,300 poles down, which was caused by this storm. The storm covered principally the area of the Chicago Telephone Company. The storm started in Missouri and the total storm damage that I show here includes the damage in

Missouri as well as the damage in Illinois. It covered to some extent the area of the Illinois Bell Telephone Company located in Chicago, with which this rate case is involved, but the principal damage was outside of the city because the entire damage was to the aerial plant and the aerial plant in Chicago is at a minimum.

This 65,300 poles represented 1600 miles of continuous pole line. There were 20,280 miles of wire down; 32,900 stations out of service. The estimated cost of reconstruction (these are estimated from the actual costs—allowing for ordinary maintenance in connection with it) was $4,926,000.

2587 I cannot give the proportion of the damage done in the State of Illinois quantitively or even by estimate, but the portion in Illinois was most severe. As far as the service was concerned, it makes no difference whether it was Illinois, Missouri or wherever it was, because the facilities are identical and the demand on the Western Electric Company was the same.

Now in order to check the services of the Western Electric Company I am accustomed, in cases of storms of this kind, to see how rapidly they are able to ship the supplies. It is one thing to be able to ship when everything is going well. It is a very different thing to be able to ship promptly when there is an enormous demand and extra people have to come in to give the service and they are inexperienced, and so on. The supplies shipped in this storm I considered for two weeks following the storm and I found that the two houses normally serving this area were the St. Louis house and the Chi-

2588 cago house. I found in this period of two weeks the following quantities of material shipped:

Bare copper wire, 2,433,000 pounds. I equated that shipment of copper wire to the shipments that were made throughout the rest of the year by these two houses and found that it represented 67% of the balance of the year's deliveries. They shipped 133,000 pounds of copper tie wire, representing 81% of the balance of the year's shipments. They shipped 142,000 pounds of bare iron wire, representing 12% of the

remaining shipments. It is not a percentage of the total shipments in the year. It is the ratio of the storm shipments and all other shipments during the entire year.

2589 They furnished 7,439,000 feet of twisted pair wire, representing 13%; 1,055,000 sleeves, representing 38%; 21,000 poles, representing 21%; 26,000 cross-arms, representing 19%. Now all these shipments were made within two weeks.

I found that in making these shipments the Chicago and St. Louis houses had to call on some of the neighboring distributing houses. The distributing houses which assisted the Chicago and St. Louis houses were the following: Oklahoma City, Kansas City, Indianapolis, Cleveland, Dallas and Detroit. In addition to those there were seven other distributing houses nearby which were not called upon to make any shipments, and more distant there were more than 16 distributing houses; so there was a very large supply still available in case of further storms in this territory or storms in some other part of the system.

2590 The shipments to which I have referred were all made within two weeks. I want to make it clear that that doesn't mean that the Western Electric Company waited two weeks to make a shipment, and in order to show what was the actual condition there I went into the time when they received the order and the time when they made the shipment. In other words you can see that where a widespread catastrophe of this kind has occurred the roads are blocked, they had to be opened up, and it takes time in order to ascertain the extent of the damage and to prepare orders for the supplies that are needed in the restoration. Accordingly, the orders coming into the Western Electric Company dribble along to a certain extent, and the Western cannot make shipments until they know what they are to ship, so the period of two weeks does not represent clearly the service that they are furnishing, it is much faster than that.

Now, to bring out that phase of it I took specific ship-
2591 ments, and these are illustrative. For example, bare copper wire, 3,500,000 pounds representing about 75 cars

of copper wire were shipped by the suppliers on the average of one day after the order was received. As much as 970,000 pounds was shipped the same day the order was received. Creosoted yellow pine poles, of these 24,000 representing 500 cars were shipped by the suppliers in from one to four days after the order was received. Of insulated wire, 14 orders totalling 10,000,000 feet were shipped by suppliers the same day the order was received. That is particularly important because this insulated wire is the wire that is used to temporarily restore service.

Now the Western Electric goes further than merely making these shipments expeditiously. It has in the ordinary course of its business a traffic department which keeps in touch with the transportation facilities throughout the United States, and the facilities of that organization are marshalled in a time of this kind in order to expedite the deliveries. Special arrangements are made with the transportation companies under which through trains are stopped at unusual
2592 points for pick-up or for delivery. Freight will be added to passenger trains, and other special combinations of that kind.

As a typical illustration of what can happen, what did happen in this case, a carload of insulated wire was shipped from New Haven, Connecticut, there is a supplier at that point, to Oklahoma City by express and was delivered in two days. A passenger traveling in limited trains could not beat that time. Each car is traced through the destination so that the telephone companies were able to know exactly where the material was and make their plans in accordance.

Another feature, this unusual emergency service has been rendered at normal cost; there is no special charge for the supplies that are furnished in this emergency plan. If a shipment goes by freight, of course the Telephone Company just pays the freight as they would ordinarily; if it went by express they would have to pay the express charges so to that extent the Telephone Company might have to pay more,

but the remuneration paid to the Western Electric
2593 Company is normal, in exact accordance with the percentages shown in the supply contract.

Now, in addition, I want to bring out that all of the supplies were inspected and known to be ready for installation as soon as received. And, furthermore, the Telephone Company was able to import from other Bell System companies experienced linemen and foremen who knew how to use these supplies and were enabled to immediately start the restoration of the plants. In that way 1938 experienced foremen and linemen were sent into the storm area from other sections of the country; 13 states thus helped, the men coming from as far away as Georgia and Massachusetts.

Instances of this character in connection with storm matters are continuously arising. I mentioned this one particularly because it was a maximum storm and was met by such expeditious relief that it shows the service is ready to meet the demands that may be made on it.

I might say, for particular reference to this section here
in the City of Chicago, that the Western Electric Com-
2594 pany maintains emergency equipment at Hawthorne, its factory here in this vicinity, for meeting fire losses. It has the special switchboards arranged so that they can be installed in units of two thousand or three thousand or five thousand lines so that if an exchange is burned out this shipment could be immediately installed. The cables are largely formed, formed as far as they can be. Every detail is prepared as far in advance as it can be; those are boxed ready for shipment on order if a fire occurred in this city.

The effect of the changes made in the Western Electric
Contract from 1924 to 1928 has been a decrease.

2595 I haven't in my head the total amount of decreases or increases from 1924 to 1928. There has been a substantial reduction steadily or you might say throughout that period, in the price of telephone apparatus and lead covered cable manufactured by the Western Electric Company. I can give the approximate amount of those reductions by years.

I have it set up here separated by lead covered cable and apparatus. In the year 1924 net reduction on telephone apparatus, $6,869,000. I should preface this by a statement showing how these figures are compiled.

What has been done has been to take all the price changes that were effective within that year and then extend them at the volume of supplies which was shipped during that year.

It does not mean that all of that amount was effective
2596 in that year because the changes were made throughout the year. Nevertheless the amount was cumulative and would have come in in the total amount next year. We have for 1924 under telephone apparatus a reduction of $6,869,000; for lead covered cable a reduction of $2,820,000. That is not a reduction in the case of lead covered cable. It is an increase.

Lead covered cable is manufactured under quite different conditions from telephone apparatus. In the case of cable, 80% or thereabouts of the manufacturing cost is represented in the cost of the raw material and it necessarily fluctuates fairly closely with the fluctuation in the cost of the raw material. The raw material—price of lead which is a very important element in the cost, was at its peak in the year 1924 and the year 1925 and it involved an increase in the cost of lead covered cable in both those years.

2597 (Plaintiff's Exhibit 71 marked for identification.)

I can testify as to the correctness of the information set forth in Plaintiff's Exhibit 71. It was prepared by my department and represents exactly what it purports to represent. On this sheet there are two sets of graphs, one represents the trend of market quotations of copper and lead using the prices in the year 1926 as 100%. The lower graph
2598 on this sheet shows the prices of lead covered cable for the same period. 80% of that cable is material; that is 80% of the manufacturing cost is represented in the material. The market quotations are taken here from the published quotations in the American metal market. The lead

covered cable prices are the composite of the prices
2599 of the lead covered cable furnished the associated companies. It shows the trend of prices of these items from 1923 to 1925 on an index number basis in a percentage.

The increase in lead covered cable was due to the increase in the price of lead as shown on tha sheet. The condition in lead covered cable is different from apparatus because in the case of apparatus the manufacturing cost has a different ratio for the item of raw materials. In the case of apparatus, raw materials represent less than 40% of the manufacturing cost.

Going back to the saving for the years 1924 to 1928. The result of the decrease on apparatus and increase in the cost of lead covered cable is a net decrease for the year 1924 of $4,049,000.00; for 1925 there was a decrease amounting to $990,000.00 for apparatus and an increase for lead covered cable amounting to $1,973,000.00, making for that year a net increase of $983,000.00.

2600 In 1926 there was a decrease of $10,294,000.00 for apparatus and a decrease of $3,092,000.00 for lead covered cable making a total decrease of $13,386,000.00.

For 1927 there was a decrease of $4,964,000.00 for apparatus and a decrease of $2,250,000.00 for lead covered cable, making a total decrease of $7,214,000.00.

And for 1928 a decrease of $17,525,000.00 for apparatus and a decrease of $2,273,000.00 for lead covered cable, making a total decrease of $19,798,000.00.

As to the basis upon which these prices are adjusted—the price of lead covered cable until the year 1924 to the Associated Companies was cost plus 8 per cent, except during a short period when it was cost plus 6 per cent. In the year 1924 the price of lead covered cable was changed so as to be on a quotation basis. Telephone apparatus is also shown on a quotation basis, the quotations being published in price lists.

2601 The Illinois Bell Telephone Company does not buy all the material that it uses in the telephone business

from the Western Electric Company. The purchases are made from the Western Electric Company to the extent that the Illinois Bell Telephone Company determines for itself. In general, it is very much to its advantage to purchase from the Western Electric Company and the great bulk of the supplies are purchased that way. However, I know that a substantial volume of supplies is purchased direct.

I made a check for the month of November, 1923, of the Illinois Bell Telephone Company's outside purchases. For that month the general auditor of the Illinois Bell Telephone Company examined the vouchers covering all of these direct purchases and furnished me a statement based thereon. That statement shows that there were direct purchases exceeding $140,000.00, and on an annual basis that would be in the neighborhood of a million and a half dollars.

All the bills which are rendered by the Western Elec-
2602 tric Company are checked by the representative of the Illinois Bell Telephone Company, who is located in the distributing house of the Western Electric Company and by reason of that fact is able to check the bills against the underlying data. That is particularly important in the case of these supplies that are purchased from other concerns on the remuneration basis because the bill which is rendered to the Western Electric Company for the purchase is sent to the Invoice Supervisor and he checks that actual bill against the bill which the Western Electric Company renders to the Illinois Bell Telephone Company. In that way, he verifies that the price paid is the net price charged to the Western Electric Company plus the remuneration provided by the contract. All he is checking is the actual price billed with the proper price that should be billed and he is not duplicating my work in any way.

2603 I am familiar with the contract of 1882 between the Western Electric Company and the American Telephone and Telegraph Company or its predecessor, the American Bell Company. There has been a revision made, as I recall it, in the year 1908. That revision provided for a sale by

the Western Electric Company of telephone instruments to other than the Bell Company itself. There has also been a change in practice which, however, has not yet been incorporated in the contract. I refer to the method of obtaining instruments, telephone instruments. Commencing January 1st, 1928, the Illinois Bell Company and the other Associated Companies obtained their instruments direct from the Western Electric Company and prior to that time they obtained their telephone instruments from the American Telephone and Telegraph Company, the American Company buying them from the Western Electric Company under a cost plus feature of this 1882 contract. Now, at the present time not only does the Illinois Bell get the instruments direct from the
Western Electric Company but the American Company
2604 itself gets its instruments from the Western Electric
Company under the same terms as does the Illinois Bell Telephone Company and not under the cost plus feature of the 1882 contract.

If desired I can give the return of the Western Electric Company, Incorporated, from its entire business and upon
its entire investment for the years 1915 to 1928 inclu-
2605 sive, year by year. I have in front of me a statement
showing for each year, 1915 to 1928, the total assets at December 31 for the particular year in question as shown in the annual reports to the stockholders of the Western Electric
Company, Incorporated, also the accounts payable as of
2606 December 31. The net assets, that is, the deduction of
the accounts payable from the total assets; then I have the net assets as averaged for the beginning and end of the period, that is, the average of the two figures for December 31 pertaining to each year. Then I have the total sales and the other income, and the total income, then the cost of merchandise, the expenses, taxes, appropriations, and the total of that classification. And from the total sales I deduct the total expenses so as to obtain the net earnings for interest and dividends and then I relate the total net earnings to the average net assets. Now, for this entire period the average net earnings—

(Mr. Haight objects on the ground of lack of qualification.)

2607 These figures are taken from the annual reports of the Company and bear the certifications of such well known outside auditors as Price, Waterhouse & Company, Arthur Young & Company, Librand, Ross Brothers & Montgomery. I have some of those reports. I have the last few years, but not the others. They can be furnished and are accessible if it is desired to examine them. This exhibit is a mere analysis of those reports and everything that is on this exhibit is taken directly from those reports of the auditors.

2608 (Mr. Haight still objects and states that he would object to the auditors' reports as not authenticated. Objection sustained.)

2609 *Cross-Examination by Mr. Goldstein.*

2610 The exhibits I testified to in this case are not the same as the ones I testified to before the Commission though they cover substantially the same ground. I don't think there are any of the present exhibits that are identical with the ones I filed before the Commission. I think there is only one that covers the same period as the exhibits that I presented before the Illinois Commerce Commission. I would have to check that out to be certain. The period in the history of the Illinois Bell Telephone Company purchases which I compared with the Independents was not the period covered in my testimony before the Commission by exhibits. My position with the American Telephone and Telegraph Company is to represent the Associated Companies in connection with their purchases from the Western Electric Company.

2611 I made an investigation of certain costs but not, roughly, comparable with an item such as a manual switchboard manufactured by the Western Electric Company and one that is manufactured by an Independent Company. The prices that I used are invariably the lowest prices that are charged by the outside or independent manufacturers and

dealers. I compared them according to list prices less
2612 all discounts. I have repeatedly checked the items actually purchased by Independent Telephone Companies against the lists of items in the price lists of the Independent Manufacturing Companies but have not checked their entire list, if I understand the question. I did not check the 102 items listed in Exhibit 65 to determine how many of those 102 items were actually sold during the period of my investigation by independent companies. All of those 102 items were quoted for sale during that period by the independents. I don't know to what extent the sales were actually made. I know whether these items listed in Exhibit 65 were also sold in connection with a completed, operative unit which I describe as being part of a lump sum contract.

2613 When I compared the prices of the Western Electric with the prices of the Independents on those units, I took the prices of the Western Electric of items that are both for the original installation and also for replacements or additions. As far as the Western Electric is concerned, their quotation is on the same basis whether the item is used in connection with an original installation or whether it is used for replacement or addition. The same thing is not true of the Independents. The practice of the Independent Companies is somewhat as follows: For an initial installation of the usual sort, quotations are made for the complete job and those quotations will make a special discount
from what the addition of the individual items would
2614 have summed up to. Those discounts would run up to, we will say 15 per cent. Now for subsequent additions to such an installation the tendency is to adhere to the full list price for the reason that there has been more or less of a necessity to extend an installation by equipment of the same manufacturer. In addition to that, there are piece parts sold which are sold at a still higher classification so that the sum of the piece parts would be very much higher than the price of the completed article. The principle that you referred to in the case of the Associated Companies or the Western Electric Company is carried not only in the in-

dividual items of apparatus but back down into the piece parts. You have in case of the Independent Companies three sets of prices, a discount of perhaps 15 per cent on preliminary installations, a list price on additions and for maintenance purposes, and a still higher schedule for items of piece parts.

I have used the lowest prices as disclosed in their
2615 individual items and represent much the highest value of a switchboard. In other words, the equipment represents the real cost of the switchboards. My basis of comparison between the Western Electric price and the Independents is not based upon the list price of the individual items. I have allowed for such a per cent deduction from the list price to take care of the discount on the original installation of those items that were used on original installations when I come to my summation of the savings to the Illinois Bell Telephone Company. I did not take that into account in connection with Exhibit 65. The comparison in Exhibit 65 is between the price of the Western Electric and the price
which could be 15 per cent lower than the list price. If
2616 we take the prices ruling as of January 1st, 1928, as disclosed by Exhibit 65, the Kellogg price is 64 per cent higher than the Western Electric price. 15 per cent might properly be deduced from that item. The Stromberg-Carlson price is 57 per cent higher than the Western Electric price. It would be quite proper to deduct 15 per cent from that item.

I cannot know exactly that there is a deduction of 15 per cent in connection with an original installation by an Independent. I simply know that the Western Electric Company is a large purchaser of material from both Stromberg and the Kellogg Companies and I know the prices which they are able to obtain. I also know the results of the Graybar Company in selling on a competitive basis with these par-
2617 ticular outside manufacturers. The basis for my conclusion that the 15 per cent allowance should be made on these list prices when original installations are made is first the experience of the Western Electric Company in purchasing from these Independents.

There is competition between these Independents in their sales to the Western Electric. On this particular line the competition is between two Independent manufacturers, the Stromberg and the Kellogg Companies. They compete
2618 with the American Electrical Company. I think the American Electrical Company would also be able to supply a substantial amount of the equipment required by the Western Electric for purchases in addition to the Kellogg Company and the Stromberg-Carlson Company. The American Electrical Company does not supply a substantial amount of that equipment. I don't know why.

There is real competition for the business of the Western Electric between the Stromberg-Carlson and the Kellogg Companies. The companies have no relationships with each other and the Western Electric Company in taking the peak off its own products has for a number of years given that either to the Kellogg Company or the Stromberg Company in accordance with the best prices obtainable from either. I should consider that kind of a situation comparable to the situation where the Kellogg Company or the other company compete for business in the open market with Independent Telephone Companies.

2619 I think that the Western would get as good prices or better than if they were competing in the open. I don't know the size of individual orders. They get volume orders. For example: There will be manufacturing contracts for P. B. X. exchanges which would run to sizeable figures. I imagine the sales for the year 1928 with both of those companies might have reached three-quarters of a million dollars. The Western does not buy on the cost plus basis from them. It buys on a contract basis, not continuing, but really on quotations on individual orders or groups of orders.

There is practically no sales purchase expense in
2620 connection with those orders because the Western goes direct to those companies. There is very little expense of drafting or designing in connection with those orders on the part of the independent manufacturers. There is no installation expense. I think the Independent Telephone Com-

pany would be charged a higher price on an order which is filled and installed in its plant. The reason for the higher price would be, first of all the selling expense, second, the necessary provision for collection expenses, and third, provisions for drafting and engineering. I haven't evaluated the ordinary amount of selling expense in my mind at all.

In a general way I am familiar with the business of
2621 the Western Electric Company to the general public prior to the sale of its other business to the Graybar Company. I haven't the figure in my mind as to what the selling expense of the Western Electric was during that period in its sales to the general public. I haven't that figure with me. The Western Electric has selling expense in sales to the general public other than the Associated Com-
2622 panies. I don't know how much it would be. I have taken into account in determining as to the fairness of the price to the Associated Companies, the benefits of this volume of business to the Western Electric. I took into account the fact that there is no selling expense to the Associated Companies, whereas there would be a selling expense in connection with outside business. I did not take it into account by giving it a factor. I took it into account in just this way. In my check of the fairness of the Western Electric prices I do not confine myself to a comparison of just the quotation prices which we have been discussing, but I
2623 personally have taken this position, that if the Associated Companies could purchase the items from the Western Electric Company at a lower cost than they could from other available suppliers, and if the Western Electric Company was making no more than a reasonable profit on its investment, then I have felt that those prices were fair, and any selling expense is, of course, reflected in the over-all profits. The price must have been low enough if the Western Electric profits were reasonable.

One of the items that the Western Electric saved the Illinois Bell Company is 4 per cent in connection with the storage or selling expense that it would have otherwise. Only as I have said over-all would I take into account the corre-

sponding items of percentage as to what was saved to
2624 the Western in not having any selling expense. I never figured that out by percentage. The only percentages I figured out are benefits to the local company. I have never in detail made an estimation of the benefits to the Western Electric by getting the business of the local company. I want to modify that to this extent, that in this part of my answer I confine myself to the manufactures of the Western Electric and I am thoroughly familiar with it.

There are important benefits that come to the Western Electric by virtue of getting the business of the local companies whom I represent and am seeking to protect in connection with the Western Electric contract. There is a very large elimination of selling expense. It is not all eliminated.

The Western has to bill and to go through the ordinary
2625 commercial processes but the advertising—If you limit the selling expense to the initial sales promotion expense, the sales promotion is practically eliminated. There are other items they have the advantage of having. There is

a very large volume of supplies of standardized items.
2626 I don't know what the promotion expense of the competitors of the Western Electric is. I do not know and have never made a calculation as to what is a fair percentage of the selling price attributable to that benefit. I do know that gross profits must include selling expense. I haven't got that in percentage but I have got the gross profits of the Graybar Company for handling sales of this character.

I don't think I ought to disclose that. It is a distinctly
2627 private business. I have neither the dollars and cents nor the percentage of selling price the promotion expense is which is saved to the Western Electric because it gets business from the Illinois Bell. I have never made such a calculation. I do not consider that as representing the Illinois Bell in its relations to the Western Electric I should make such a calculation.

The benefit to the Western Electric by getting the business is important in determining the benefits I say accrue from the Western to the Illinois Bell, and it is taken care of

in the method that I followed and also the results of that have been disclosed in the reductions to which I testified a few moments ago. Those reductions have no relation to the
2628 selling price of competitors at all. Assuming that the selling expense is 15 per cent, which is saved to the Western Electric and the Western Electric charged the Illinois Bell 5 per cent less than the Kellogg price to the Illinois Bell, I think that the Illinois Bell is getting a fair deal with the Western Electric. The Illinois Bell, if it dealt with the Kellogg Company exclusively, and the Kellogg Company was in the position of the Western Electric Company with all the advantages, it is entirely conceivable that the Kellogg Company would be able to give prices conmparable to the
2629 Western, but until you get to that point the conditions are different. I say that the Western price to the Illinois Bell is over ten per cent cheaper than the Kellogg
2630 price. The difficulty of answering the question as to whether the Western Electric is making more profit or less profit than the Kellogg Company by having this business from the Illinois Bell, because it limits promotional expense, is just this, that you have taken a study based on 1921 sales and are considering that in connection with sales at a subsequent period. Now the prices I have used in estimating my profits to the Illinois Bell are based on 19 per cent saving. The fact that the Western Electric does not have any
2631 sales promotion expense is an element in the 19 per cent saving. The promotion expenses to the Western Electric because of its contract with the Illinois Bell are largely saved. I do not know whether they amount to 15 per
2632 cent or not. I do not know how much the promotion expenses would amount to. I assume 15 per cent would not be unreasonable.

On Plaintiff's Exhibit 68, I show a saving under the contract to the Illinois Bell in its purchases from the Western Electric Company of 7.88 per cent. If the Western Electric were to maintain the same profits that it maintained at the time when I made this study and reimbursed itself for the promotion expense of 15 per cent, the cost to the Illinois Bell

for that merchandise would not be 7.2 per cent higher than the Kellogg price. The reason for that is, first of all, 48 per cent of the entire purchases were for items which were found to be noncomparable and the price for those items was assumed to be exactly the same for the Kellogg and other competing companies as for the Western; so that at least for 48 per cent of the items I have taken care of the question of selling
2633 expense, engineering or any other features.

Of the total purchases from the Western Electric I compared 46 per cent on apparatus. I compared the 46 per cent purchased from the Western Electric with the equivalent amount purchased from the competitors. The saving is shown in the table as 5.72 per cent, but as shown on the first sheet of the exhibit and as stated orally, the real percentage is at least twice as great as that. It is at least 11 per cent. That 11 per cent is a saving to the Illinois Bell by buying from the Western Electric Company as compared to buying the same merchandise from the competitor.

2634 In buying that amount of merchandise from the Western Electric Company, the Western Electric did not have the 15 per cent selling expense that the competitors would have had for the same merchandise. If the Kellogg people sold that same merchandise to the Illinois Bell, they would have to include in the selling price 15 per cent for sales expense. The Western Electric price includes some promotion, probably not as much as the Kellogg. It is probably not over 5 per cent. There is possibly a difference of at least 10 per cent to the Illinois Bell under this contract with the Western Electric that it does not have from the others. It would
2635 not be wholly correct to reduce the Kellogg price by 10 per cent to place them on the same basis as the Western Electric, or to add 10 per cent to the Western Electric price in order to reduce the prices to the same level, because as shown in this study there is a further item here of supplies expense. Possibly on any item that the Western Electric sells to the Illinois Bell the 100 per cent of that price is 90 per cent of the Kellogg price, because the Kellogg price in-

cludes as an expense 10 per cent for selling that the Western Electric price does not have. If the articles are identical
2636 that would be true. It is true that every item I have given in the list is exclusive of the 10 per cent selling expense. I think it is true at the present time that if I want to compare the list prices of the Western Electric with the list prices of the Kellogg Company I have to reduce the Kellogg price by 10 per cent or add 10 per cent to the Western Electric's price in order to make them comparable.

2637 The detail which would go to make up such an exhibit as this Exhibit 68 is shown on Exhibit 65 and they are the individual items of apparatus which have just been mentioned. Now you can run down these percentages and make these deductions and you will find there is still a sub-
2638 stantial margin in favor of the Western Electric Company prices. I will admit that it is true that in order to have a fair comparison between the prices of one company and another, you have to make an adjustment for the 10 per cent selling expense, but I want to qualify it with this statement that I want such comment applied to Exhibit 65, which shows the prices in detail, and not against Exhibit 68, which is a general and broad treatment of the whole subject.

Exhibit 68 was a study of the actual purchases of manual telephone apparatus and lead-covered cable during the year, but it treats the thing very broadly. By broadly I mean you have these other items that are thrown in there of differences in supply expense and items not comparable, all of
2639 which go to make up a general picture. The price of $3,074,574 in Exhibit 68 representing the selling price by the competitors probably includes a 10 per cent selling expense of that competitor. When I said it probably does, I used "probably" as relating to the per cent and not the fact. A competitor who has a selling expense must include the selling expense in the selling price. In the item $2,908,090, which is the Western Electric Company's price, there is included such selling expense as they have, but it is smaller than the

corresponding item for an independent company. I imagine that the difference would be about 10 per cent.

2644 I have never checked the cost of manufacturing a manual switchboard which has been installed in the City of Chicago, but I have investigated manufacturing costs.

2645 I have assumed that 46 per cent of the merchandise purchased by the Illinois Bell during the period under investigation was comparable to items sold by other manufacturers. That does not mean to say it was as good or suit-
2646 able for the purposes in this area. That leaves a balance of 54 per cent purchases. 6 per cent of the balance relates to lead-covered cable, and on that item the comparison is a direct comparison with the lowest competing prices of other concerns as found by their actual billing prices to independent companies. For 48 per cent of the items the assumption was made that if the articles had been purchased elsewhere than the Western Electric Company, that the same prices would have been obtained. I think the last assumption is an unfair basis to the Western Electric. I assume that the manufacturer of an article that cannot be purchased in the
2647 open market will not make more profit on that article than he does when he has to compete. But the detail of that item should go into the picture. Some of those articles are articles which are sold exclusively by the Western Electric and only to Bell System Companies. They are like the load coils or repeaters and are not offered to others. They are of very great value. They are patented and the use of those remain with the Bell System. Now I certainly am very much more than fair when I take an article of that kind and say an associated company could have bought it from some outside concern at the Western Electric Company's price, which provides nothing for royalties on patents. On this particular study I did not make a check with the Western Electric Company officials as to this 46 per cent that has no open market to determine the profit on it, but I made over-all checks of the output of the Western Electric Company, as I already stated. This output is of both comparable and non-comparable items.

2648 I have made a study of the output of non-comparable items to determine the reasonableness of that cost. The investigation was of this nature: I reviewed the Western Electric Company costs and found that they were just on the same basis for the non-comparable items as they were on the comparable items. There is not any distinction in price between the non-comparable items and the comparable items. I make these studies more or less all the time. I have made a specific study with reference to a particular class of equipment. I have had access to Western Electric Company records. I can review them in the possession of the Western Electric Company. These special studies are not worked up in the form of these exhibits that I have produced showing compari-
2649 sons. I have only a general knowledge of my review of their costs as a basis for my conclusion that as to the non-comparable items the costs are reasonable. It is a conclusion based on ten years' intimate knowledge of those figures.

I have never made a study of the cost of the Western Electric manual switchboard as a completed unit sold to the Associated Companies. In a general over-all way I have gone into the costs of machine switching. I did not go into the costs of the installation in Chicago at the time of the first installation in 1923, but I have made such studies for other territories. I determined whether the cost of installation of the machine switching apparatus at that time was reasonable. I have with me here such a study. The practice of the Western Electric Company is identical in the different territories and I can give you the figures for a large study on installation
2650 expense. This statement shows the billing by the Western Electric Company to the New York Telephone Company covering the comparison of billing on manual switchboard installation, with complete costs for all jobs on which work was started and completed in the period of July 1, 1923, to June 30, 1924.

I don't think there was any panel switchboard in Chicago in 1923. I have no figures on that. I have no figures to show

the cost, including installation, of panel equipment any-
2651 where. I have never made a study of that in a formal shape such as this. I have reviewed costs. I have made a study in an over-all way to determine the reasonableness of the costs of that installation of the panel-type switchboard. By over-all way I mean to say taking the complete installation, not only in Chicago but throughout the country, of manual and of machine switching panel type, it is a general over-all picture. I have never made a study of any particular installation. I have never made such a study for any particular company. I have never made a study to determine the ratio of installation costs to costs of equipment in the original installation as compared to the later installations.
2652 I do not recall how the purchases of the Illinois Bell Telephone Company of its original panel type equipment were made. I know the New York Telephone Company purchased its equipment on the same basis. I think the purchases were made on the cost plus basis. As I refresh my memory now, the cost was given in estimated form but not in a fixed lump sum form, at the time the order was given. I don't know how the original estimate compared with the final cost. I did not make a study for the earlier years. I do not think that for the earlier years I should have made such a
2653 study as a representative of the Associated Companies. The reason why I did not make that study in the earlier years was because the machine switching program was a new program. The engineering department of the American Telephone & Telegraph Company was giving its intimate attention to it and it would have been a sort of duplication of effort to put it over into the function I had. It would not have been of any value to me to make inquiry from the Engineering Department to get the figures. That part of it was out of my province. I did not say that I could not ask them to supply me with the figures whereby I could determine the reasonableness of that charge. I could have asked but it was out of my province. They were handling it. During those earlier years it was out of my province to look into the reasonableness of the cost to the Illinois Bell Telephone Company of the

panel type equipment manufactured by the Western Electric Company. The Engineering Department was handling it.

2654 I have no idea as to the ratio of installation expense to the cost of equipment in 1923 and in the original installation as compared to 1926. I know that the Western Electric in billing to the Illinois Bell or to the Associated Companies for this panel type equipment was billing at a reasonable charge for that particular type of equipment. I know that because the profits on that side of the business were almost at the vanishing point. By that side of the business I am talking about the machine switching equipment installed in the earlier days. I do not know as to the matter of the allocation of the original expense by the Western Electric Company in making the tools and in creating the new model, as to whether that was distributed over the initial purchases by the Associated Companies.

2655 There were higher profits on manual than there were on machine switching. The average of the two together is the figure I have already quoted. With regard to the initial sales of the panel type equipment, I have said that I did not examine that billing in detail because the Engineering Department was doing it. I have since then reviewed the subject in a broad way; I mean for the Bell System as a whole, and I know that in those earlier years the profits were at the vanishing point. Obviously, if the Western Electric was to

2656 make a reasonable return on its whole business, some other items as a whole must have served to bring the average up to an amount which is something less than 7 per cent for the entire output.

I would not put it that the losses on panel type equipment were shifted to other types of equipment sold by the Western Electric to keep up the profits of the Western Electric. An illustration that would represent it more thoroughly would be the Ford Motor Company. It has changed its model to a new model. The new model, if in the earlier days of its introduction it had to stand the cost of conversion of the plant from the old model to the new model, there would be no Fords sold.

Obviously there has been a broadening out, a leveling of charges for all classes of items if the company is to continue in a position of reasonable profit. The price was not absorbed in the new car, and the price in the case of this machine
2657 switching equipment did not all go against the machine switching equipment. It is exactly the same leveling out process. In the case of the Ford Motor Company the expense was charged to surplus and taken from past sales. In the case of the Western Electric Company those profits have been kept down to an amount that is less than 7 per cent.
2658 In the case of the Western Electric they were deducted from future profits of the Western Electric to quite an extent. In other words, the prices that were charged the Illinois Bell and other Bell System Companies was a shaken down price. By that I mean the price at which this equipment could be sold after five years was estimated as the current price. What it could be sold at after five years, that is the price that was charged to the Illinois Bell. Now, the balance representing a higher initial cost must have come out of some other phase of the Western Electric Company's business. The Western Electric Company's profits on the sales to the Associated Companies were kept at the same figure after
2659 the panel type equipment was installed. Had it not been for the expenses coming in on panel machine switching at a greater rate than on other items, the prices on other items would have been cut even more than they were cut. It is a very different thing from increasing prices in order to take care of extra expenses.

It is a fact that the Associated Companies make approximate estimates at least a year in advance of their requirements for the ensuing year, and that these estimates are
2660 available in a general way to the Western Electric Company. Roughly, 90 per cent of the sales of the Western Electric Company is represented by sales to the Associated Companies, so that as to this 90 per cent of the total volume, the Western Electric Company gets the estimates a year in advance. It is helpful to the Western Electric in enabling it

to make its schedules as to the purchases of raw material. It enables the Western Electric to purchase in large quantities and to get maximum discounts and to manufacture at an even rate throughout the year instead of having peaks and ebbs. I have already covered selling promotion expense or salesmen's commissions. It has no bad debts in its dealings with
2661 the Associated Companies. As ordinarily understood it has no collection expense. That is, it does not have attorneys' fees to collect its bills and does not have to dun the debtor to pay and all that sort of thing.

The Western Electric makes a good deal of preliminary promotion sketches and setups in anticipation of getting an order or in order to get an order. For most of these sketches it gets an order. When a competitor solicits a job, that competitor makes up a sketch to meet the requirements and that is very largely eliminated in the case of the Western Electric. The standardization of equipment is made by the A. T. & T.
2662 That standardization enables the Western to manufacture in quantity and to eliminate a lot of items and to concentrate on the large ones.

The development costs of the Western Electric are not all charged to the A. T. & T. The part of the development costs that are charged to the A. T. & T. are the costs that cover the fundamental development work and the costs that do not lead to the actual production of apparatus. Once a type of apparatus has been determined upon, all of the costs in designing that particular piece of apparatus, making it suitable for manufacturing under the particular plant conditions of the Western Electric, are included in the price exactly the same
2663 as they would be for any other commercial concern.

There is a good deal of development in the particular article manufactured. For example, you may make a certain part out of brass, but the qualities of that brass are important and become a feature of development, and that is done by the laboratories for the Western Electric. I have roughly in mind the figures of the amount charged to the A. T. & T. by the Western Electric Company for development costs in the

years 1923, 1924 and 1925. A rough estimate is in the neighborhood of 2 million dollars. The Kellogg Company does not engage in much of this kind of work for which this 2 million dollars would be attributable. They don't do that fundamental development. They get the benefits of the Bell
2664 System experiments and design the apparatus from their own experience. They do not have a fundamental development such as the Bell System has. I doubt if there is any part of this 2 million dollars a year that is an expense item which the Kellogg Company would have. There is very little but I would not estimate how small.

I have no knowledge of the percentage of bad debts the Graybar Company had in connection with sales to the public. The figure I have been using in the past of 15 per cent was intended to include all those commercial expenses, not just solicitation but all commercial expenses.

2665 I would say that the ordinary manufacturer sends out merchandise, and also after the installation sends them catalogues to tell them how to use the apparatus, and that is a customary thing for a manufacturer to do. The Western Electric does that. It furnishes information in much greater detail than Kellogg or Stromberg Company does, for instance, card catalogues.

I know whether the general staff of the A. T. & T. sends instructions to the Illinois Bell or sends them pamphlets telling them how to order Western Electric equipment, and whether through the general staff there are sent to the Illinois Bell pamphlets telling them how to use Western Electric Company equipment. The Western Electric Company does not stand any of the expense of printing or sending out that advice, but that sort of expense is not incurred by an inde-
2666 pendent manufacturer. An independent manufacturer does not send a pamphlet telling the customer how to order his equipment comparable at all with what is furnished the Associated Companies through the A. T. & T. It is purely incidental in comparison with the other. It is included but it is minor. I have never made a study to determine what per-

centage of pamphlets that are sent to the Illinois Bell relate to the use of the Western Electric equipment. In general it is impossible to take a Western Electric switchboard and put
items of Kellogg and Stromberg in it. That could not
2667 be done with any other manufacturers. It cannot be
done with the Western Electric Company. It is then a general rule that is applicable throughout the industry, that once an installation is made by a manufacturer that the replacements or additions necessary must come from that manufacturer.

I know that there are in excess of 125,000 items manufactured by the Western Electric Company. I have chosen 102 items for the basis of comparison with competitors but they are not counted in the same way. The 102 represents completed pieces of equipment, completed coded items of equipment. I don't know how many coded items of equipment are sold by the Western Electric but the individual pieces or parts that
make up these reach with the Western Electric over 125,-
2668 000 different things. I guess there were 13,000 coded
items. I carry in mind that there are 8,000 relays alone. There would be in excess of 13,000 anyway. I selected 102 for the basis of comparison. The percentage they bear to the total equipment is, however, very large and these items in each case represent the leading items of their classes by volume, and as their prices rise and fall, the prices of the related items rise and fall.

I have no estimate as to the percentage of savings coming to a manufacturer as a result of this association, based upon
the selling price of the Kellogg Company. I have never
2669 made a study. I have not made a study to determine the
amount of savings to the Western Electric because of the elimination of the items of expense and of the economies that come from the relationship for these reasons: That it would be pure speculation and whatever benefit comes from this program of consolidating business, all the profits that come from that are carried through to the Associated Companies by keeping the return to the Western Electric on its business reasonable.

I think you have to consider a comparison of the list price of a company that did not have the economies and had all of those expenses, with a company that had all the economies and saved all the expenses, and also consider both with the economies and saved expenses. My Exhibit 65 shows the detailed comparison of the list prices, all discounts having been taken. It is perfectly proper in my opinion to reduce the percentages shown there to cover these advantages. Now that is entirely apart from the particular question of whether it would be advantageous to make purchases from other companies,
2670 and I don't think that would require any argument on my part. That factor should be taken into account in making a comparison between two companies.

In a measure, the same thing is true as to Exhibit 68, to the extent I compared the items of the 46 per cent but with this qualification. As I said before, Exhibit 68 is a broader basis than this Exhibit 65. I have gone further in making my comparisons of equivalents. I have given more to the independent companies in the way of showing that, while even if it is not as good as what we use, nevertheless we will put it into the exhibit.

I have here a chart which shows the prices for the years 1920, 1921 and 1919 and there is not any evidence here of
2671 a change in prices between 1920 and 1921. There is no change in prices of equipment. The general level of equipment as sold by the Western Electric Company remains substantially constant. The charges of independent companies for their equipment remains substantially the same for those two years. There was a break in commodity prices, such as copper, lead, and paper.

Competitors' prices in individual items shifted more or less all through the year. The range in certain items went up to 25 per cent. Some went down, others went up. I can-
2672 not speak in detail about it. I only know general conditions. If the commodity prices came down the Western Electric could get the benefit of the price changes, of course. It does not often buy distress merchandise thrown on the

market because of depression. I do not recall whether it did in 1921. The competitors change their list prices from time to time and send out sheets notifying their customers
2673 to that effect. It is a mere speculation to say how soon the change in price of raw material would be reflected in the change in price in the finished article when it may be balanced by an increase in the cost of labor. It is pure speculation.

In my comparison I have treated both companies alike. I don't think it follows that the Western Electric because of its volume had a greater opportunity to take advantage of a break in price or purchasing distress merchandise than a competitor would. I have an approximate idea of the comparative volume of telephone apparatus manufactured by the Kellogg Company and the other competitors of the West-
2674 ern Electric for the years 1923, 1924 and 1925. Of course, it is very rough. I should say that for the Kellogg and Stromberg Companies the outputs of telephone apparatus in those years would be on the order of four or five million dollars each. Perhaps 10 or 15 per cent of that would go to the Western Electric Company. Something like eight and a half million dollars between the two companies would go to the independent telephone companies. In 1927 the Western Electric sold to the general trade through the Graybar Company about 3 million dollars of items strictly comparable to
2675 the group we are considering. In 1927 it sold 130 millions to the Associated Companies.

The Western Electric Company covers the entire field of communication services, whereas these other companies deal in much more confined limits. So that the volume of their business in their limits is very much closer to the Western Electric Company's volume than is indicated by the figures. The eight and a half million represents telephone appa-
2676 ratus and equipment. The amount of telephone apparatus and equipment sold by the Western Electric Company still is not comparable, because the Western Electric Company's ratio is so much greater. If you are talking about some kinds of apparatus volume sold by Kellogg and the vol-

ume sold by Western Electric, you have a much closer relation than 8 and 130. The benefits of volume production would enter into all the items saved by the Western Electric Company, but not to the extent of these figures.

I think the Bell Telephone Laboratories was organized January 1, 1925, but I am not sure. Before that time the
2677 Bell Telephone Laboratories were physically under the care of the Western Electric Company and was handled as a department of the Western Electric. The Electric Research Products Company was established January 1, 1927. Prior to that the functions were performed by the Western Electric.

This International Standard Electric Corporation was the International Standard Electric Company prior to 1925, and at a prior period again—I don't know just when—that
2678 also was handled by the Western Electric as an export branch of its business. Taking the picture broadly, around 1923 and 1924 the Western Electric Company did the work of the Bell Telephone Laboratories, of the Electric Research Products and of the Graybar Electric Company. It did not do the work of the International Standard Electric. The work immediately prior to the period you have under question was handled by the International Western Electric Company, which was a wholly-owned subsidiary of the Western Electric Company, Incorporated.

The Western Electric Company carries the accounts of Associated Companies 45 days after shipment. The Western Electric always takes its cash discounts, which are provided for prompt payment, so the payment to the manufac-
2679 turer is usually within ten days of shipment. The regular discount varies. As an average I carry in my mind about 2 per cent. Those are usually 2 per cent on Western Electric dealings. When they get their discounts it would be 2 per cent net, 10 days. In certain cases the Western Electric has an arrangement with its manufacturers to carry them longer than 10 days. I cannot name the cases, all I know is

there are some. I cannot quote figures as to the percentage of this volume carried on. It is not in every case 10 days. That varies.

2680 The Associated Company does not get any discount if it anticipates its payment. What happens is this: It is more convenient both to the Western Electric and to the Telephone Companies, instead of paying in a lump sum at the due date, to take one-third of it and pay that 15 days in advance, and take another third and pay that 15 days in arrears. By 15 days in advance, I mean of the due date. Shipments made during any month are billed at the end of that month and are payable 30 days thereafter. Now instead of making that payment 30 days thereafter, one-third is paid 15 days thereafter; one-third 30 days thereafter; and one-third 45 days thereafter, so it averages up in accordance with the contract.

On jobbing business of the Western Electric for the local company, the billing made by the manufacturer or supplier is to the Western Electric and the Western Electric to the

2682 Illinois Bell. In other words, the account is the Western Electric account. There is no distinction in Western Electric Company billing between that and its own manufacture. The Western Electric in connection with purchases by it, takes all discounts and pay at the minimum time. The minimum time is roughly cash in 10 days. As I under-

2683 stand it, it is the same with respect to raw material for its own manufacture. In the first or second year of the organization of the Graybar Company, something like 15 or 20 per cent of the telephone equipment sold in the United States other than to Associated Companies was sold by the Graybar Company. That was about the same as when the Western Electric was selling to the general public.

In the manual operation there are three principal independent telephone manufacturers: Kellogg, Stromberg, and the American. The first two are the principal ones.

The patents that the International Standard Electric Company makes available to the Western Electric Company are

embodied in merchandise sold to the Bell System and in
2684 merchandise sold to the Graybar Company for resale to the public, to the independent telephone companies.

All of the patents of the Western Electric Company that relate to telephone apparatus, including the right to the use of those patents of the International Standard Electric Company come under the general provision of assignment to the A. T. & T. that gives the same rights as the patent. Included in the patents and patent rights that the A. T. & T. has for the benefit of the associated companies, are such rights as the Western Electric may get from the International Standard Electric.

I have not said that some special companies get prices about the same as the associated companies. The cases
2685 where there was 5 per cent difference relates to distributor companies of the Western Electric Company. Those distributor companies are the ones that on Exhibit 64 are shown in the lower half of the chart: Electric Research Products, International Standard Electric, Northern Electric and Graybar Electric.

The arrangement with the Graybar Electric is on the same basis today and this is after employees have bought the stock from the Western Electric. The Graybar Electric Company has no license contract with the A. T. & T. The Graybar Electric Company does not pay the A. T. & T. anything for getting this special price from the Western Electric other than what comes in through the profits of the concern. At the present time the Graybar Company is not owned by the Western Electric.

2686 I have made an examination of the purchases in 1926 by the Tri-State Telephone Company. I did not make the complete study myself. I went to St. Paul—I reviewed the study. There were no lump sum contracts to the best of my knowledge in this period. I don't think there were any in that year. There was one lump sum contract which covered a completed toll switchboard. The amount of the

actual price was $11,875.00. Of course the specifica-
2687 tions for that were available to me and I had those specifications complete, bid upon by the Western Electric Company and checked those figures by our engineering department so I know what it would have cost the Western to build that particular board. Here is a lump sum of $10,000.00. That is a fairly considerable item. I could not tell you how many previous installments were made to which these purchases in 1926 were applicable, nor how many switchboards were installed prior to 1926 that were replaced.

2688 The purchase by the A. T. & T. Co. of merchandise from the Western Electric Company on the basis of cost plus 20% relates only to the item of telephone instruments under the so-called 1882 contract. Those were the instruments leased to the associated companies prior to 1928 and then sold to them on January 1, 1928. I know the cost to the A. T. & T. in 1923 of telephone instruments. A complete set of instruments for common battery on January 1,
2689 1923, would have cost $3.23. It is not the present practice for the Illinois Bell and other associated companies to purchase these instruments from the Western Electric on the basis of cost plus 20%. Those items are priced now on a basis of a quoted price. There is no cost plus feature connected with it. At the time the A. T. & T. sold these instruments as of January 1, 1928, the arrangement of cost plus 20% was still in effect with the A. T. & T.

The percentage of manual switchboards purchased by the associated companies from independent manufacturers is small. I don't know what it is. It is negligible as against purchases from the Western Electric. If you include private branch exchanges I would have to modify that statement, because there is a very substantial volume of private branch exchanges, purchased from the Stromberg Company.

Mr. Bloom is the president of the Western Electric Company. He is not an officer of the A. T. & T. Co. He
2690 came from the American Company. I do not recall, but I do not think that he is a director of the A. T.

& T. I think it will be disclosed by the Annual Report. He is not included as a Director in the Annual Report of the A. T. & T. for 1928.

2691 I haven't a copy of the 1904 contract but I can work
2692 back to it. City Exhibit 55 being the contract of November 5, 1904 between the Western Electric Company and the Chicago Telephone Company contains the following provision: "The Telephone Company agrees to buy all its telephonic appliances, apparatus and supplies and material, excluding only such articles as may be from time to time specifically designated by the Telephone Company, from and through the Electric Company and to pay for the same, all as hereafter provided." This is the first time I have ever known there was such a provision. I have never examined the contracts between the Western Electric Company and the Associated Companies as far back as that. I commenced this work of comparison of prices of independent telephone companies and associated companies in 1919. I never checked
2693 back on any work covering this but I can make this general statement which may meet the point you have in mind. This form of contract was tried out experimentally in 1901 with one company and the other companies then had somewhat similar arrangements. No standardization was made until 1906. Now, this is one of the irregular contracts that was subsequently merged into a standard document. I am positive that the provision referred to did not stay in that contract until 1919 but I cannot give you the exact date when it came out. I never knew of such a clause in any of the contracts. I have never seen such a contract until this minute and never heard of such a provision in any of the associated companies' contracts. I have not checked the Western Electric Company's contracts back of 1919, though I have statements that cover details back of that period. They would not cover that. The first year in which I
2694 undertook the work of the Western Electric Company was 1919. At that time there was no such arrangement at all of changing contracts to conform to requirements of the Federal Trade Commission.

2695 At the request of counsel I made a special investigation as to how long Section 10 of the 1924 contract (City's Exhibit 56), relating to the termination of the agreement, contained the clause that the termination shall be as follows: "By the termination of the license from the A. T. & T. Co. to the Telephone Company or to the Electric Company." I find that the first appearance of that provision is in the contract of 1906. The contract of 1904 apparently did not have it. It has been in all contracts since 1906.

With reference to the item of non-comparable items installation $541,000.00, on page 2, Exhibit 68, I would
2696 have to analyze that item in order to refresh my mind on it. I haven't reviewed it for a great many years. In the case of these lump sum contracts by competitors, that is a lump sum which includes the items plus the design plus the installation. The practice today of the Western Electric is to list items and make a separate charge for installation and a separate charge for engineering and drafting. I don't know what this particular engineering and drafting covers. I would have to refresh my mind on it. There have been changes in that particular phase and I can't equate those without refreshing my mind on them. I can't answer at the moment whether drafting and engineering had reference to installing these items or not.

2697 P. B. X. switchboards are manufactured by others. By the terms "no similar items manufactured" I mean that no P. B. X. that could be at all compared with the P. B. X. that are involved in these cases.

The figure, $818,000.00 includes items that were specially restricted. It would include loading coils; that is probably a very important element there.

I speak of 4 per cent as being saved to the local company because of not having a selling and a storage charge. I would have to think about what is a fair amount for a company of the size of the Illinois Bell to set up for that item. I can tell you why I selected 4 per cent. It was because the Western Electric at the date of this study was charging 4

per cent for handling items that were shipped direct
2698 from the suppliers to the telephone company. In other words, there was no storage involved at all. It was in direct handling. They were doing the function of the purchasing agent only. I should add that I know that that 4 per cent was fair because I made an investigation and know that it would return approximately 6 per cent or less on the investment. Now it seemed to me perfectly fair to assume for the entire supply expense, a rate which in the case of the Western Electric represented the purchasing only. Now if the Illinois Company did this work, they would not only have to purchase, but have to store a portion of the supplies, so 4 per cent is unquestionably low. To make an offhand estimate, I should say that it would not be less than 10 per cent.

I take the net prices after all cash discounts—all cash and all quantity discounts—in all cases of comparison. I
2699 do not take discounts in connection with lump sum contracts. Excepting from the Western Electric Company, central office switchboards are usually installed under lump sum contracts.

Prior to the sale of the Western Electric business with the general public to the Graybar Company, the apparatus going to the two classes of customers was made in the same factory as far as manufacturing was concerned, but as far as
2700 distributing was concerned, the two phases of the business were handled not only by a separate organization but in separate buildings. They were physically kept apart.

The Northwestern Bell has owned stock in this telephone company in the Northwest. That company made an arrangement with the Northwestern Bell. The circumstances of that were these. The Northwestern Bell Telephone Company and the Tri-State Telephone & Telegraph Company both were operating within the state of Minnesota so they were competing in the main cities. In order to adjust that very undesirable condition, the two companies agreed to sell each other plants so they would operate without local competition. In connection with that, the Northwestern Company sold much

more of its plant to the Tri-State than the Tri-State sold to the Northwestern. That meant there was a balance due the
Northwestern Company and instead of taking that in
2701 cash, it took it in stock. That stock was retired prior
to the date of the sub-license agreement. It was prior to July 2nd. I don't remember making any such statement, that it was on July 2nd. I should say further that it was non-voting stock. It was special preferred stock.

I spoke of the sleet storm in 1924. The Western Electric made sales to independent telephone companies during that same period. It did not render them as good service as the Illinois Bell. It gave the Illinois Bell the preference. I might say there that I thought it would be interesting to review the services that the telephone companies got from
other suppliers and I investigated some fifteen or six-
2702 teen other companies not Bell controlled and obtained
from them the statement of their purchases and the rapidity with which the supplies were furnished and I compared them with the Western Electric Service to the Bell Company and found that the Bell service was superior. I don't know anything about the finances of the independent companies. I am only talking about the shipment of supplies. I am talking about prompt shipment. It is the date
of the order and the date they got their goods.

2703 The saving in 1928 of 16 per cent is computed on all
purchases from the Western Electric. I don't recall the connection in which I used the 7 per cent profit item to the Western Electric. The percentage of profit to the Western Electric that I considered is the average return which
was made for the last 14 years based on net assets. That
2704 is to say, total assets less current payables, but I want
to say this, that that is not my measure of an adequate return or a fair return. I think it is much too low. In figuring a 7 per cent return on the net assets, I arrive at the net profits by deducting the expenses from the sales. I have gone into the sales for particular years. I did not go into them for all of 14 years but I spot-checked the fourteen years and I am in touch with their reports. They pass my desk

and I know the reports are in harmony with the reports shown in the annual reports.

2706 I haven't checked all the allocations of the expenses between the Western Electric Company and the various subsidiary companies, but I checked certain ones, enough to satisfy me that they were correctly made. I did not make the allocation for any particular year complete. I did not make a detailed study of the profits and losses and the allocation of expenses and revenues for one particular year of those 14 years of the Western Electric Company. I made what you would call spot checks. I have seen figures or made a check of figures prepared by others showing this allocation for a particular year of the 14 years. I have checked other figures and other statements. I have seen statements

2707 which showed the itemized revenues and expenses of the Western Electric by departments so as to separate the profits for the business sold to the Associated Companies from other companies. I have not such a statement with me. I saw them off and on for all the years. I mean to say that as occasion occurs where an item of that kind is of particular interest, I have seen the company's own report and have worked from those company reports with what studies I found necessary. I made a spot check from time to time as to such allocation. I have not in my possession or available. any such data which indicates the allocation. That

2708 data would be in the Western Electric Company, principally in New York. I am not an employee of the Western Electric Company. I have been given the courtesy of seeing the actual working papers so I know the statements I have had are not specially prepared for my consumption. I do not have with me a record of any working papers upon which I base any of my conclusions.

I know how the Western Electric Company sets up its reserves for depreciation on its fixed assets. That is done this way. The life in service is estimated and the depreciation is set up on a straight line basis as a liability.

2709 Dividends have been paid by the Western Electric. Various rates of dividend have been paid, depending on

its particular years. From 1918 to 1926 the dividend on the common stock was $10.00 a share. In 1915, 1916 and 1917 it was $8.00 a share.

The Western Electric has declared a stock dividend. It was in 1927. The stock has been split up. I don't want
2710 to be technical about that but I am assuming that the exchange of one share for five shares made in 1927 might be classed as a stock dividend. It is simply so many more pieces of paper for the same assets. They did not capitalize any surplus. The surplus for many years was always shown opposite the common stock. I think in 1927 there actually was a surplus shown separately. When the common stock was issued the Western did not continue to pay $10.00 a share on the new stock. The dividend was changed from 1926 to 1927. There had been a change in stock there, so the dividend became $2.00 a share instead of $10.00 a share.

That was in 1927. In 1928 the dividend was raised
2711 from $2.00 to $3.00 a share and in 1929 it was put at $4.00 a share. The effect of that change was to raise the dividend from $3.00 to $4.00. I would have to work out the effect of the change for 1926 and 1927. There was a change in the amount of stock issued. There was not a change in the rate. I don't know just what it would be. This condensed statement I have in front of me isn't sufficient to answer those questions, including also whether any surplus was capitalized.

2712 The 7 per cent item that I figured was on the book value of the assets. The book value of the assets contain all of the assets in all of the departments. There were no departments in the Western Electric that were in red or that earned less than 7 per cent. There was one year when the department that sold to the general public and to the independent telephone companies did show a red figure but checking it over the average of all of those years the return on that department was greater than the return on the Bell System department. That department sold all sorts of merchandise in addition to the telephones. There was
2713 no allocation of telephone equipment from other departments in that department. I did not have the fig-

ures on whether the red came from the department of telephone equipment or the other. I know the way the overhead is distributed and in 1923, 1924 and 1925 it followed the standard basis of distributing overhead. That basis was determining as far as could be the actual time spent for the different departments and the dollar of expense followed the allocation developed in that way.

The supply department of the Western Electric handling merchandise that was sold in competition purchased from the telephone department on the same basis that the Graybar
2714 Company has been purchasing. In other words, it bought at the price which the telephone department sold to the telephone company so there were really two profits there. It was profitable for the Western Electric to manufacture and sell their apparatus, then the supply department took it and had to make another profit on it. When the supply department purchased from the telephone department it got the benefit of everything done by the Western Electric in connection with the development of all those instruments. The 10 percent that was sold to the others got the benefit of all benefits that came by virtue of the 90 percent volume from the Associated Companies and it was reflected in the price they paid. It was not reflected in the distribution of the costs.

There was never at any time a distribution of $47,000,000 in stock by the Western Electric Company to its stockholders as a stock dividend. I think you have in mind a cash
2715 dividend in approximately those figures two years ago.

The A. T. & T. owned 98.3 per cent of the stock of the Western Electric. The $47,000,000 cash dividend was in addition to the regular dividend.

Re-direct Examination by Mr. Bangs.

The large cash dividend represented the profits from the sale of the International Western Electric Company which was exclusively engaged in export business, foreign business, the revaluation of companies such as the Graybar Company and

the Northern Electric Company in Canada, both of which
2716 had nothing to do with the Bell System business and
also included certain profits from the non-Bell business taken over a number of years previously. No Bell system profits were included in that at all. I don't think a reasonable manufacturers' profit should be less than ten percent. I think that is a good profit for a manufacturing concern. I have personally made a study of some 67 companies whose net annual profit exceeded a million dollars in recent years, and of those companies at least three quarters of them made profits in excess of ten percent on their investment. In computing profits I computed them on the same basis on which I computed the Western Electric profit average of 7 percent
as nearly as could be done by published reports in Pool's
2717 Manual and individual reports.

I originally testified in this case in the form of an affidavit. With the exception of Exhibit 64 and Exhibit 71, that affidavit had attached to it all the exhibits which have been introduced and all of the exhibits which have been referred to by me.

Re-cross Examination by Mr. Goldstein.

I don't recall whether any of these 67 companies with whom I made a comparison had any relationship with purchasers of their products, such as the Western Electric Company. I really don't know about that. The General Electric Company
is in there and the General Electric Company has many
2718 subsidiary companies but I don't know just the basis on
which they are handled. I did not make a study of every one of the 67 companies to determine the conditions under which they operate, to determine how comparable they are to those of the Western Electric. The profits of the Western Electric have increased in recent years. I don't know whether since 1924. They are now about 10 percent. I don't think their business is now running better than 10 percent. They are running above 9 percent. It would take quite a period of years running over 10 percent to balance off the 15 years of less than 7.

2719 I have investigated the matter of the Western Electric employees benefit and pension fund. The Western Electric within the last few years has set aside money for that purpose based on actuarial studies. I carry in my mind about $16,000,000. The earnings that I have figured are after making this deduction which is in accordance with the provisions of the Federal Revenue Act which permits just such deductions as that.

2729 *Re-direct Examination by Mr. Bangs.*

I testified as to the 16 million dollars which has been set aside by the Western Electric Company for its employes' pension and benefit fund. Those accruals go back to the year 1906. The accruals in each year were charged against the earnings of that year. There was no lump sum charge of $16,000,000.

Re-cross Examination by Mr. Goldstein.

I know there was no lump sum charge because I had a special report prepared for me on that which I reviewed with the men that prepared it. I reviewed that report about three weeks ago. I have it with me.

2758 The Employees Benefit Plan used by the Western Electric Company is of the same kind as that used by the other parts of the Bell System, and included in this plan is the provision whereby the employees of any part of the system who come to the Western Electric, and any employees of the Western Electric who go to any part of the Bell System, get the benefit of the employment in the company which such employee left in the computation of its benefits under the plan. The Western Electric Company, Inc., is a New York corporation and succeeded to the business of the Western Electric Company, an Illinois Corporation in 1915.

2838 ANDREW SANGSTER, called as a witness on behalf of the plaintiff, in rebuttal, testified:

Direct Examination by Mr. Bangs.

My name is Andrew Sangster; my residence, Chatham, New Jersey. I testified for the plaintiff in this case. I made or participated in an examination of the company's books and accounts from the period of its inception in 1881 down to 1911. At the time that examination was made, I was employed by the accounting firm of Marwick, Mitchell, Peat & Company, Chicago. That firm of accountants was employed by the City of Chicago to make an examination of the Chicago Telephone Company's accounts. I was in
2839 charge of the work. That report was compiled and delivered to the city and known as the Marwick, Mitchell, Peat & Company report.

I later made an examination of the company's books from 1911 to 1919 and then later from 1919 down to June 30, 1923. With reference to the method of examination I made of the company's books covering the period from 1911 to 1923—before I made any attempt to examine the plant accounts of the company, I considered it would be advisable for me to familiarize myself with the work and duties and responsibilities of all of the departments who were in any way directing or supervising the plant construction work in that way—for that purpose I visited the engineering department, plant department, the maintenance department.

I also visited the central division headquarters of the construction superintendent. I had conferences with the heads of the various departments to explain their organization and the divisions in which their departments were organized.
2840 In the engineering department I discussed with the building engineer, for instance, various steps of the work done by him in preparing for building construction, the preparation of floor plans and negotiations with the architect for structural plans and receiving of bids from the contractors. I also had explained to me by the equipment engineer, just

how he prepared his specifications and plans and drawings that were submitted to the Western Electric Company in obtaining proposals for the central office installations.

I also had the outside plant engineer in that department explain to me how he prepared his plans and drawings, showing the work that was to be done on the outside plant. Those plans indicated the new construction in heavy lines and existing facilities in light lines. The amount of plant to be displaced was also indicated on those plans.

In the plant superintendent's office, I had the estimate supervisor explain the methods that he used in preparing estimates or schedules of the material and labor that would be expended on construction work.

I also visited the equipment installation department 2841 of the maintenance division. That department had to do with the installations of central office equipment and the displacements at central offices.

I also visited the record department, the record division in that department, which kept records of outside plant, maps and plans and files, showing the dates of installation of poles, conduit and cable.

I also visited the assignment division of that department where the records of stations installed and removed, disconnected and re-connected were kept, and examined the method by which those statistics were assembled and sent to the plant department, plant accounting department, for record purposes.

I had several discussions with the construction superintendent and the central division headquarters for the purpose of ascertaining just how he reported the expenditures for material and labor as between construction, maintenance and cost of removing plant, and so on. I found that he was guided and controlled by the plans which he received through the estimate supervisor from the outside plant engineer.

I also made a general survey, preliminary survey of the accounts and records kept by the plant accountant and studied

the method by which he had recorded materials pur-
2842 chased for the different estimates, specific and routine,
and how materials were handled, that is, requisitions, sources, how payrolls were recorded and the labor distributed over the estimates.

I also investigated the method of applying supply expense to the different estimates and distributing overhead charges for engineer expense and plant supervision and tool expense and general administration.

After making that general survey of the different departments I made an abstract of all of the larger specific estimates which had been authorized during the period from July 21st, 1911, to June 30, 1923. That abstract I made for the purpose of getting a general view of the changes which had taken place in the plant in the various central office districts; and I listed those estimates by central office districts in order to get that view.

This file also showed the amounts authorized to be expended on routine estimates.

There was also a card file of engineering orders. Those are orders issued by the engineer for work to be done under routine estimates, generally speaking for outside plant; and
I listed a number of typical engineer orders which would
2843 show how expenditures of retirements had been handled under routine estimates.

From this abstract I made a selection of a number of the large specific estimates that involved both additions and retirements of the plant.

Furthermore, I made the selection so that it would cover all of the primary account classifications in the plant accounts.

I then went to work in the plant accounting department with a corps of assistants and checked up all of the material charged to those specific estimates and engineering orders. We had produced to us the bills of the Western Electric Company for materials purchased and delivered direct on the job and therefore chargeable directly to the estimate.

We had the requisitions for materials taken out of the store-rooms produced to us. We examined those and checked the prices at which those materials were charged from price lists of the Western Electric Company, if Western Electric material, or material obtained from the Western Electric Company, applying at the time that the material was used.

We also checked the application of supply expense
2844 which was charged on all material other than contract material, that is, material furnished by contractors.

We also had the man-tickets of various classes of labor charged on those estimates. Those covered tickets of central office equipment installation force; that was where the work was done by the company, of course; station installing—installation force by the Company's installation force; aerial construction gangs; underground construction; cable placers; cable splicers; cable testers and building cable forces.

We also checked the average rate per hour which was applied to the time charged to those estimates, which average hourly rates were obtained from the payrolls during each month, or each half month, depending on the manner in which the payrolls were compiled.

We also checked the application of overhead expense covering engineering expense, plant supervision engineering, plant supervision proper, tool expense and the administration expense charged to construction.

I also went very carefully into the record of retirements of plant during that year. I studied retirement unit
2845 costs in the case of buildings. The investment in buildings is kept in a real estate ledger or real estate record. That record showed the amount of cost, the land and the structures on each piece of property by location, so that when a building was taken out of service the real estate record furnished the basis for recording the retirement; when buildings were taken out of service, where they were not disposed of at the time, they were transferred from the plant account to the account of miscellaneous investments; that is, they were taken out of plant in service. Retirements of central office

equipment—where there was a complete displacement of a central office unit the equipment engineer used a record kept in the treasurer's department. This was a card record, showing the amount reported on specific estimates by central offices. This record, however, did not allow for, as a general rule at any rate, for estimates which covered more than the central office; nor did it as a general rule, allow for routine estimates which would cover a number of offices; and the equipment engineer had to make suitable allowance for equipment installed under such estimates. Retirements or partial displacements of central office euipment were based on reports.

2846 As far as I deemed it necessary to do so, I made as full and complete a check of all the operations of plant accounting as it was necessary to make in order to form a conclusion as to the integrity of the plant accounts. In the second examination we began to work in December of 1923 and completed it about March or April, 1924. Approximately, that covered the period from 1919 to 1923. Some time was spent on a previous examination. I was given free rein by the company's officers to make any inquiry that I desired and I was asked to make any criticism of plant accounts which I thought should be made.

2847 I was not entirely satisfied with the record of retirements on central office equipment. In order to obtain some check on retirements as recorded, I made a rough distribution of the expenditures on estimates, for each of the central offices as nearly as I could and added the results which I obtained to the Byllesby-Arnold appraisal figures, scaling those figures down in proportion to the book figures. That study indicated that in some central office units there were some expenditures standing on the records that ought to have been left off. I took the matter up with the general auditor and recommended that he make a study along similar lines; but of course, he could make a much better study with the cooperation of the engineer of equipment; and I believe that study has been made and some corrections have been made. As to what corrections have been

made as a result of that study, I am informed that a certain amount has been written off the accounts for old central offices which are no longer in service.

2848 I made some recommendations as to what I thought would be a proper way to apply these retirement unit costs. I have no criticism from the point of view of conservative accounting as to the application which the company had made of these retirement unit costs. During the period of 1911 to 1923, which I examined, which was a period of increasing prices, the tendency would be to reduce the cost of the remaining plant by the company's method. That applies only to outside plant. There were no criticisms or suggestions of any importance made by me other than the two items I have just mentioned.

As a result of the investigation which I made at various times, of the accounts of the telephone company, I have an opinion whether the fixed accounts of the capital are correct in all fundamental respects and that the integrity of those accounts has been preserved and maintained. With the
2849 necessary reservation in respect to central office equipment accounts, as showing on the records as of June 30, 1923, I believe that the book figures to a substantial degree show the actual cost of the property. I believe as a result of this examination that the fixed capital accounts of the company correctly represent expenditures for additions, betterments, and replacements, subject to proper allowance for overhead charges not included, and that retirements of property have been duly accounted for in the said accounts. I mean by my exception, subject to proper allowance for overhead charges not included, that there are certain elements of overhead charges which have been included in the plant accounts only since the year 1920; those elements comprise interest during construction, traffic engineering, and commercial engineering. I don't recall any other just at the moment, but those items of overhead have only been included in the plant ac-
2850 counts since the year 1920. There is nothing included for taxes during construction or law expenses during

construction for the entire period that I examined. I made an examination of the books and records of the New York Telephone Company similar to the examination that I made of this company's books and records. In general, the accounting methods are the same.

Cross-Examination by Mr. Haight.

I myself made checks to see if retirements had been made. I made a check in connection with some of those complete displacements of central office equipments that are referred to.

2851 I also personally made a check of retirements of some of the buildings. I mean by that that I actually did check all the displacements in those cases though they were not all of the cases that were checked.

The recommendations concerning which I have testified were in connection with the examination of the books made by me covering the period from 1919 to 1923. That examination was made in the winter of 1923 and 1924. I found carried on the books certain items of property that I recommended should be removed because they were no longer used. Those items referred to central office equipment installations. I have not examined the records since I made the recommendation, but I am informed that they are now removed.

2852 My studies did not disclose any such items appearing on the accounts between the years 1911 and 1919. Of course, I made the study covering the entire period from 1911 to 1923. That may have developed over the entire period.

Other than traffic engineering and commercial engineering, the Illinois Bell capitalized its engineering services over the entire period from 1911 to 1923. A certain amount of engineering expense relating to construction was on the books for that entire period.

2853 In connection with the retirements, I would say that the figures coming to whoever kept the books were not dependent, in a very great measure, on the judgment of some-

body connected with the company in ascribing values to property retired, in the case of buildings or in the case of outside plant. The value at which the outside plant was retired was determined from the reports sent in from the field of the plant actually retired; that was capable of check from the engineer's plans, it could be verified. The amount at which it was retired was determined by the application of those retirement unit costs. As I recall, they began to use retirement unit costs about the year 1920. Prior to that time, the retirements were based upon the studies made of costs of various
2854 types of plant installed during the years 1908, 1909, and 1910. I cannot say as to how many individuals were engaged in making the study of those particular unit costs. I don't believe that prior to 1920 the value at which plant was retired depended on somebody's judgment within the company. It depended on those studies which were made
2855 in 1908 down to 1910. Those were the studies that were used for retirements up to 1920.

So far as I know, the Illinois Bell did not capitalize on its books any engineering expenses rendered by the A. T. & T. Item 271, on page 43 of the uniform system of accounts, referring to engineering, provides, "This account should include all expenditures for services and expenses of engineers, draftsmen and superintendents employed on preliminary and construction work when the expenditures can not be assigned to specific construction accounts."

2856 *Re-direct Examination by Mr. Bangs.*

Important cases of retirement due to fire losses are those which involve the wholesale destruction of station apparatus, for instance, or other apparatus belonging to the telephone company on the premises of subscribers. We used the records of the fire marshal of the city of Chicago to direct us to cases of important fires, for instance. We then went to the company's records showing the equipment of various kinds in the destroyed premises, and checked, as far as we practically could, the retirements of that property.

I am familiar with the uniform system of accounts and have an opinion as to whether the accounts of the company have been kept in accordance with that uniform system of accounts since the date of its institution.

2857 I think they have been kept substantially in accordance with the spirit of that uniform system of accounts.

Re-cross Examination by Mr. Haight.

When I used the word "substantially" in stating that the accounts have been kept substantially in accordance with the uniform system of accounts, the difference I had in mind was those omitted overheads not placed in the company's plant accounts, in part. That is the particular item I had in mind,

2857 U. F. CLEVELAND, recalled as a witness on behalf of the plaintiff in rebuttal, testified:

(Plaintiff's exhibits from 64 up to and including 75, that have not already been offered, admitted in evidence.)

Direct Examination by Mr. Bangs.

My name is U. F. Cleveland. I live in Oak Park. I am the general auditor of the company and have testified before.

2858 Plaintiff's Exhibit 77 was prepared by me or under my supervision from the books and records of the company. It is similar to the statement for eleven months of 1928 which I introduced in evidence during my cross-examination and is the statement that Mr. Bangs requested me to prepare at that time.

(Plaintiff's Exhibit 77 admitted.)

2859 I heard Mr. Sangster testify. Corrections were made in the central office equipment plant accounts as a result of a study which I made at Mr. Sangster's suggestion. After the central office equipment distribution had been made by location of the various switchboards and apportionments to those locations made of such items as were not definitely tagged at the time of installation, it was found that there were

certain offices which had been entirely displaced or had small balances aggregating, I think, in all the offices about $105,000. Those items were displaced after I had discussed the situation with the operating officials of the company and satisfied them that it was at least good judgment to make those displacements even though it was not definitely established that they should have been made.

Cross-Examination by Mr. Haight.

We did not make a redistribution of central office equipment accounts after the examination of the books made by
2860 Mr. Sangster. We never kept the accounts other than in total. We had no record of the accounts by the exchange locations. We built up a record of that sort.

After identifying with each location such property as was covered by the specific estimates and tagged with the locations, and such items as covered by the routine estimates which could be reasonably allocated to one of these exchange premises, there were some miscellaneous items which had no definite tag attached to them. These were apportioned to the various offices, so that we, in fact, established an investment value for each of the different offices in Chicago. Having established that value, we found that with respect to this item there were five and probably six offices that had been abandoned where there were balances, and of course the entire equipment having been removed, there should be no money value left. After satisfying ourselves that there was a
2861 reasonable assumption that we had underdisplaced with respect to those offices, we made displacements thereof, approximately $105,000.00. Subject to the possibility that it may not have been an excess, it was so determined by the officials that we would speak of it as an excess of plant upon the books and displace it. We did not make the same sort of examination in regard to any other accounts, only the central office equipment.

Referring to Plaintiff's Exhibit 77, the first item, "Gross Originating Long Lines Tolls $4,490,167.89," represents the

amounts which the users of the toll service paid for it.
2862 The income which is identified on that exhibit as applicable to 510 is the entire income from that plant. It does not include leased wire revenues. Those items are the items covered in items 512 and 514, which are theoretically excluded. The computation that leads up to the determination of 45 per cent of the gross originating tolls that comes to the Illinois Bell excludes any revenues from that part of the plant and operation related to other than message tolls, this statement being the distribution of the revenue from message tolls only. Other sources of revenue that are
2863 excluded are reimbursement for the plant and services involved in the leased line operation. The Illinois Bell for this period got $288,000.00 for the use of its plant assigned for use of leased line business and the operating—that is the third from the last item on the exhibit. The second item on the exhibit, "number of originating long line messages," relates to completed messages and refers only to the number of outgoing, as it says, originating messages. The amounts cover both incoming and outgoing. We have no incoming, specifically tagged as incoming business.

2864 U. F. CLEVELAND resumed the stand:

Direct Examination by Mr. Bangs.

(Plaintiff's Exhibit 78 marked for identification.)

Plaintiff's Exhibit 78 was prepared by me or under my supervision and I believe it to be true and correct. This
2865 exhibit simply continues for the years 1926, 1927, and 1928, the information requested by the city and shown on their Exhibit 42.

Plaintiff's Exhibit 78 offered in evidence. Objection. Admitted.

2866 Plaintiff's Exhibit 79 admitted.

(It is stipulated that the list of notes in City's Exhibit 77 includes notes that were not purchased by the Illinois Bell.)

2867 Plaintiff's Exhibit 80 admitted.

2908 BEN B. BOYNTON, called as a witness on behalf of the plaintiff, in rebuttal, being first duly sworn, testified:

Direct Examination by Mr. Bangs.

My name is Ben B. Boynton, my residence Springfield, Illinois. I am a lawyer and I practice before the Illinois Commerce Commission and Public Utilities Commission. I
2909 represent the Illinois Bell Telephone Company and also represent Independent Telephone Companies, and am General Counsel for the Independent Telephone Association.

At Mr. Bangs' request I examined all of the orders entered by the Illinois Commerce Commission for the Independent Telephone Companies between June 30, 1923, and April 1, 1929. The purpose of that investigation was to ascertain whether or not the findings of the Commission as to depreciation were based upon the reports of the Engineering Department. The result of my examination of the orders for
2910 that period is set forth in Plaintiff's Exhibit 47 for identification. In very few of the cases did I have to go back of the Commission orders to determine whether or not the depreciation rate had been fixed by the Commission's Engineers. I think the Commission's orders themselves set forth practically all of them. The information set forth on Plaintiff's Exhibit 47 is taken directly from the Commission's orders.

There were several orders entered into by the Commission during this period in which there was no finding at all on depreciation. Two of these orders happened to have been listed here and shown on Plaintiff's Exhibit 47. With the exception of those two orders no orders were listed in Plaintiff's Exhibit 47 which contain no findings on depreciation. I have some of the orders. I did not say that there
2913 were cases where the Commission made findings as to depreciation and did not use anything from the Engineering

staff. I stated there were a number of cases where there
2914 were no findings on depreciation. The 97 orders listed in Plaintiff's Exhibit 47 does not contain all the orders of the Commission during this period.

2915 (Certified copies of all of the orders of the Illinois Commerce Commission listed in Plaintiff's Exhibit 47 for identification admitted.)

Cross-Examination by Mr. Goldstein.

I examined all of the telephone cases that were decided by the Illinois Commerce Commission from June 30, 1923, to 1929. There were several cases involving the Illinois Bell Telephone Company's properties. I don't remember the
2916 exact number. I represented the Illinois Bell Telephone Company in all their cases except the Chicago case. During the period from June 30, 1923 to 1929, I represented the Illinois Bell Telephone Company before the Commerce Commission in at least four rate cases. There might have been some more.

I have not the exact number of telephone cases that were decided by the Illinois Commerce Commission during that period. After my talk with Mr. Goldstein the other day I briefly ran through a couple of volumes, and I would assume that there are 40 more cases that were not listed in Plaintiff's Exhibit 47. Those 40 related to independent companies.
2917 In addition to this there are also the cases of the Illinois
2918 Bell Telephone Company. I can recall four right now. I know I represented the Illinois Bell Telephone Company in all their cases. I don't want to say now that four was all there was. That is all that comes to my mind at this time. I examined those 40 cases to see whether there was a finding as to depreciation, that is all, and, since it was not my purpose, I did not keep an accurate count of them.

City's Exhibit No. 157 offered in evidence. Objection by plaintiff. Sustained after argument of following motion to strike.

City's Exhibits Nos. 157-A, 157-B, 157-C, 157-D, 157-E, 157-F, 157-G, 157-H, 157-I, 157-J offered in evidence.

2919 Objection by plaintiff. Sustained after argument of following motion to strike.

2920 Commission's Exhibit 13-A admitted in evidence. Commission's Exhibits 28, 29 and 30 admitted in evi-

2921 dence. Commission's Exhibits 31, 32, 33, 34, 31-A, 32-A and 34-A admitted in evidence.

2925 City's Exhibit No. 43 admitted in evidence.

2940 Plaintiff files a written motion to strike certain exhibits and testimony, which motion is as follows:

Now comes Illinois Bell Telephone Company, plaintiff in the above entitled cause, and at the conclusion of the testimony taken in said cause (reserving unto itself the right to introduce testimony in rebuttal, if the matters herein referred to are not stricken from the record) moves to strike from the record the following exhibits introduced by the City of Chicago, intervenor herein, to-wit:

Exhibit 47—Extract from annual report of president to stockholders of American Telephone and Telegraph Company for the year 1911.

Exhibit 73—Extract from annual report of president to stockholders of American Telephone and Telegraph Company, December 31, 1902.

Exhibit 90—Extracts from annual reports from 1881 to 1928, inclusive, of president to stockholders of American Telephone and Telegraph Company.

Exhibit 90—1881 to 90-1928, inclusive, being annual reports of president of American Telephone and Telegraph Company to stockholders.

Exhibit 86—Magazine article from Bell Telephone Quarterly of October 24, 1924, "A Publicly Owned Institution."

Exhibit 87—Magazine article from Bell Telephone Quarterly of October, 1925, "The Bell System."

Exhibit 88—Group of advertisements of American Telephone and Telegraph Company taken from certain magazines.

EXHIBIT 89—Advertisements of American Telephone and Telegraph Company from three publications.

EXHIBIT 78—Copy of injunction order of February 8, 1913, in *Read* v. *Central Union Telephone Company, et al.*, in the Superior Court of Cook County, Illinois.

EXHIBIT 79—Certified copy of final decree in *Read* v. *Central Union Telephone Company.*

EXHIBIT 123—Contract of American Telephone and Telegraph Company with Central Union Telephone Company of 1891.

EXHIBIT 124—The same as Exhibit 79.

EXHIBIT 144—Being certified copy of order of dismissal in case of *Read* v. *Central Union Telephone Company.*

EXHIBIT 83—Resolution of Board of Directors of Illinois Bell Telephone Company of October 27, 1920, relating to purchase of Central Union Telephone Company property.

EXHIBIT 84—Resolution of stockholders of Chicago Telephone Company of February 12, 1913, relating to purchase of Central Union Telephone Company property.

EXHIBIT 134—Being certified copy of Notice to Stockholders of Chicago Telephone Company, dated December 1, 1920.

EXHIBIT 91—Being sheet from Public Utilities Report showing advances from American Telephone and Telegraph Company to Associated Companies.

EXHIBIT 92—Order of Public Utilities Commission of Illinois in the Peoria rate case known as No. 3043, dated April 17, 1918.

EXHIBIT 114—Statement showing depreciation reserves of various public utility companies as of December 31, 1923.

And further moves to strike from the record any and all testimony relative to said exhibits, and any and all testimony relative to the purchase by Illinois Bell Telephone Company (formerly Chicago Telephone Company) of the properties of the Central Union Telephone Company in the State of Illinois, and of the purchase from Central Union Telephone Com-

pany by any other telephone companies of the property of the Central Union in the States of Indiana and Ohio.

Plaintiff, in support of its said motion as to the transactions last mentioned and the exhibits and evidence with reference thereto, attaches hereto a certified copy of the order of the Public Utilities Commission of Illinois entered November 30, 1920.

Plaintiff contends that said evidence is not admissible on the ground that it is immaterial to any of the issues presented by the pleadings herein, and is a collateral attack on the said order of the Public Utilities Commission.

As to said Exhibits 47, 73, 86, 87, 88, 89, 90 and 90-1881 to 90-1928, inclusive, plaintiff moves to strike said exhibits on the ground that they are irrelevant and immaterial to any of the issues presented by the pleadings herein, that they are not binding on the plaintiff, and do not constitute any proof of facts relative to the issues presented; that they are not declarations or admissions of any of the parties before the court, and that the effect of their introduction in evidence would be prejudicial to the proper trial of the instant proceedings and the determination thereof.

Plaintiff moves to strike Exhibits 78, 79, 124 and 144, consisting of orders of the Superior Court of Cook County, and Exhibit 92, the order of the Public Utilities Commission of Illinois in the Peoria rate case, as irrelevant, incompetent and immaterial and not binding on the parties to the record.

Plaintiff moves to strike Exhibits 83, 84, 91, 114, 123 and 134 as incompetent, irrelevant and immaterial.

3011 Motion sustained as to the following exhibits and said exhibits are stricken:

The first City Exhibit 90, being extracts from annual report.

3012 City's Exhibits 86, 87, 88, 89, 78, together with a stipulation regarding the same in the record, 79, 124, 144, 83,
3013 84, 134, 91, 114, (intervenor voluntarily withdraws Exhibits 91, 114, and the first 90, being extracts from the annual reports). Intervenor excepts.

3015 Plaintiff withdraws certified copy of order of Public Utilities Commission of Illinois entered November 30, 1920. Intervenor objects to the withdrawal and takes exception to the permission that it may be withdrawn.

The motion to strike made by the plaintiff is overruled with regard to the following exhibits:

City's Exhibits 47, 73, the second 90, (90-1881 to 90-1928 inclusive), being the annual reports from 1881 to 1928, 123, and 92.

WILLIAM F. SLOAN, recalled as a witness on behalf of the plaintiff in sur-rebuttal, testified:

Direct Examination by Mr. Bangs.

There are the following differences between Plaintiff's Exhibit 50, prepared by me, and Mr. Cox's testimony on the amount of cable used by the Company:

1. Mr. Cummings, in examining the working papers supporting my Exhibit 50, failed to include the house cable under code 35-C, which resulted in an omission of almost 100,000 feet of cable;

2. The figures submitted by Mr. Cox include toll cable, while my figures are exclusively exchange cable; and

3. The quantities of cable shown by Mr. Cox are all cable purchased by the Illinois Bell for use throughout its entire area, while the cable used by me is confined to that placed in the Chicago division only. For example: Out of 700,000 feet of 22-gauge cable used in the year 1921 throughout the entire Company, only 295,000 feet were used in the City of Chicago.

Moreover, I have rechecked my data on the amount of cable actually charged to construction during the year 1921, and find that the cable quantities used in my work sheets supporting Plaintiff's Exhibit 50 are correct.